WILCOM T207

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INSTRUCTION MANUAL
MODEL T207
LONGITUDINAL BALANCE TEST SET

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MODEL T207
LONGITUDINAL BALANCE TEST SET

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1.0 INTRODUCTION

1.1 This manual provides the operating instructions and field service information for the Model T207 and Model T207E Longitudinal Balance Test Sets.

1.2 The Model T207E detailed information is included in Section 10 - Difference Data.

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2.0 SPECIFICATIONS

2.1 Balance Circuit

2.1.01 Range of Balance Measurement: 10 to 100 dB (direct reading).

2.1.02 Accuracy: ±1 dB for balance readings up to 80 dB over the full frequency range of 40 Hz to 4 kHz.

±3 dB for balance readings to 100 dB and frequency to 1 kHz. Better accuracy, typically attainable, is assured as follows:

If the CAL balance reading is at least 13 dB greater than balance reading, the balance reading is accurate to ±1 dB.

2.1.03 Provisions for Self Calibration of the basic balance test circuit.

2.1.04 Connections for 1 port and 2 port circuits or devices.

2.1.05 Provision for "series balance" and "shunt balance" two-port measurements.

2.2 Generator

2.2.01 Signal applied longitudinally to balance test circuit.

2.2.02 Single Frequency:

Range: 40 Hz to 4 kHz in two decade ranges.

Harmonic Distortion: at least 55 dB below level of fundamental frequency.

Voltage: 1 volt and 10 volts, switch selectable; accurate to within ±2%.

2.2.03 Broad Band:

Waveform derived by passing a 60 Hz balanced triangular wave through a C-message weighting filter.

Voltage: 1 volt rms.

NOTE: The BROAD BAND balance test is an extra feature of the T207. Its purpose is to provide a meaningful single balance measurement for acceptance testing or for comparing similar equipments.

2.6 General

Power: 115 Volts ±10%, 50-60 Hz (T207E: 230 Volts ±10%)

Size: 15-½"W x 10-¼"H x 11"D (including cover)

Weight: 26 lbs.

3.0 DESCRIPTION

3.1 General

3.1.01 The Model T207 Longitudinal Balance Test Set is designed to measure the longitudinal balance of single-port or two-port circuits and devices. This test set permits evaluation of relays, feed coils, networks, long-line units, amplifiers and other equipment present on the typical communications circuit. These devices may have poor longitudinal balance and thus contribute to the susceptiveness of the facility. The measuring technique and circuit configuration conforms to the proposed IEEE Standards for Longitudinal Balance Measurements.

3.1.02 Longitudinal balance measurements may be made at single frequencies in the range of 40 Hz to 4 kHz. Also, as an added feature of the Model T207, a figure of merit balance measurement may be made using a shaped waveform which is representative of a power induced noise spectral distribution. Single frequency measurements on circuits with balance approaching 100 dB can be made with a typical accuracy of ±1 dB.

3.1.03 A source of d.c. current is provided for the device under test to facilitate the simulation of actual operating conditions.

3.1.04 The presence of hum and noise in the circuit under test can result in an indication of apparent poor balance. A validation check is provided to determine if external signals have affected the balance measurement.

3.2 Balance Circuit

3.2.01 Figure 1 shows a simplified circuit arrangement of the basic balance test circuit. The a.c. signal configuration conforms to the requirements of the proposed IEEE Standard. The DC bias is introduced through the balance resistors R1-R2 or R3-R4. At the ends of these resistor pairs remote from the terminals, a nulling circuit detects and nulls any signal-frequency voltage difference which might otherwise be present due to non-zero and non-equal impedances in C1-C2 or C3-C4.

3.2.02 Internal adjustments are included to pre-balance each pair of balance resistors. The final adjustment is brought out to the front panel for balance calibration to the required accuracy.

3.3 Generator

3.3.01 The signal generator oscillator is tunable over the frequency range of 40 Hz to 4 kHz in two overlapping decade ranges. It has very low distortion and a closely controlled output amplitude. The frequency of the signal is displayed to the nearest Hz on a 4 digit LED readout.

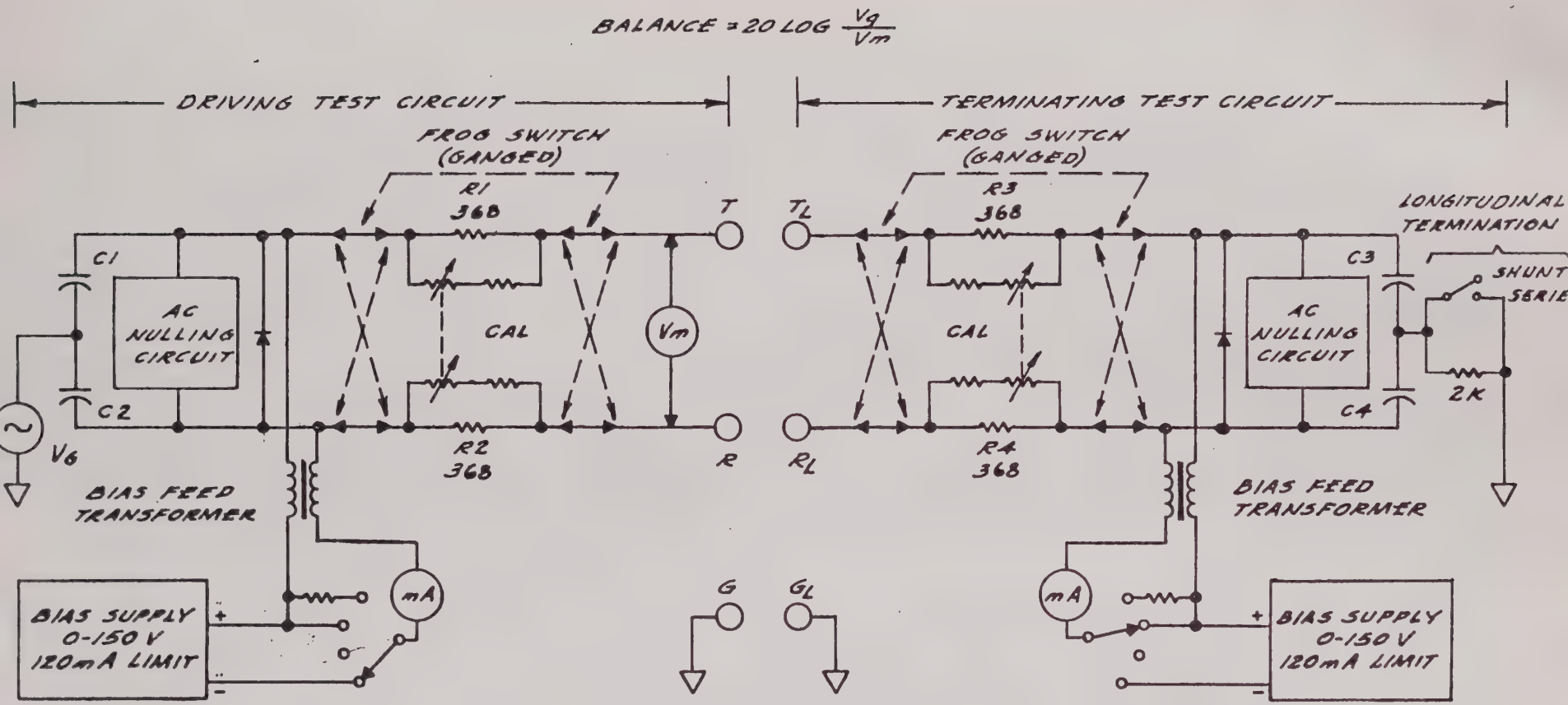

FIGURE 1

T207 Longitudinal Balance Test Set

Simplified Schematic, shown with BALANCE TEST switch in FWD position

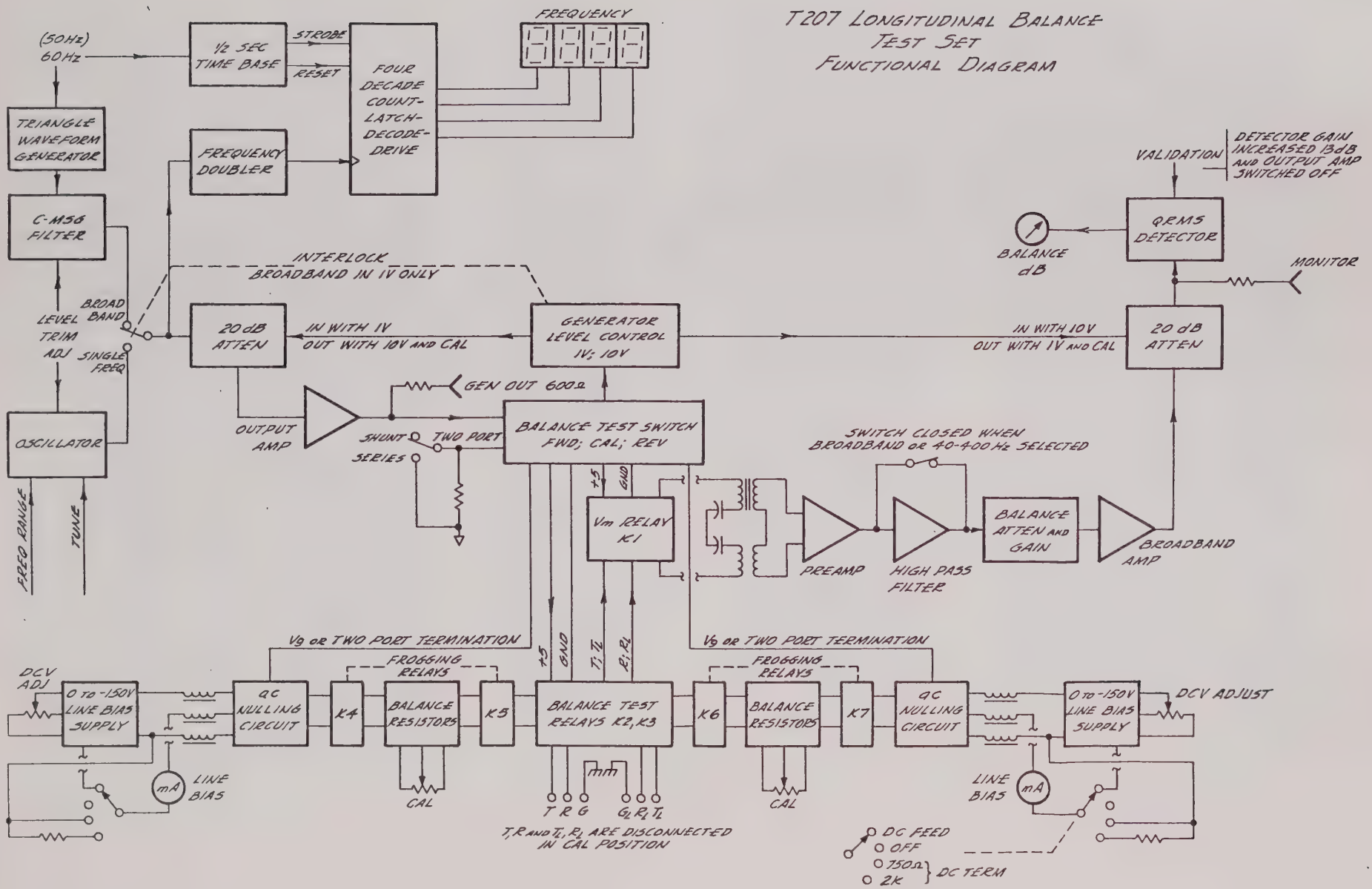
T207 LONGITUDINAL BALANCE
TEST SET
FUNCTIONAL DIAGRAM
(50Hz)
60Hz
½ SEC TIME BASE
STROBE
RESET
FOUR DECADE COUNT-LATCH-DECODE-DRIVE
FREQUENCY
FREQUENCY DOUBLER
TRIANGLE WAVEFORM GENERATOR
C-1156 FILTER
INTERLOCK
BROADBAND IN IV ONLY
LEVEL TRIM ADJ
BROAD BAND
SINGLE FREQ
20 dB ATTEN
IN WITH IV
OUT WITH 10V AND CAL
GENERATOR LEVEL CONTROL IV; 10V
IN WITH 10V
OUT WITH IV AND CAL
20 dB ATTEN
VALIDATION
DETECTOR GAIN INCREASED 13dB AND OUTPUT AMP SWITCHED OFF
QRMS DETECTOR
BALANCE dB
MONITOR
OSCILLATOR
FREQ RANGE
TUNE
OUTPUT AMP
GEN OUT 600Ω
SHUNT
SERIES
TWO PORT
BALANCE TEST SWITCH FWD; CAL; REV
SWITCH CLOSED WHEN BROADBAND or 40-400 Hz SELECTED
+5
GND
Vm RELAY K1
PREAMP
HIGH PASS FILTER
BALANCE ATTEN AND GAIN
BROADBAND AMP
Vg or TWO PORT TERMINATION
FROGGING RELAYS
T; T1
R; R1
DCV ADJ
0 to -150V LINE BIAS SUPPLY
QC NULLING CIRCUIT
K4
BALANCE RESISTORS
K5
BALANCE TEST RELAYS K2, K3
K6
K7
CAL
LINE BIAS
mA
T R G
G1 R1 T1
T, R AND T1, R1 ARE DISCONNECTED IN CAL POSITION
DC FEED
OFF
750Ω
2k
DC TERM
DCV ADJUST

FIG. 3-2

3.3.02 The generator output goes through a LEVEL attenuator switch and the PUSH TO VERIFY control to an output amplifier which provides 1 volt or 10 volts rms at a very low impedance. This is the voltage V_g applied to the balance circuit.

3.3.03 When BROAD BAND operation is selected, the test signal is derived by first generating a 60 Hz (power-line derived) traiangular waveform and then processing it through a C-message weighting filter. The triangle wave contains odd harmonics of 60 Hz, inversely proportional in amplitude to the square of the harmonic number, and is intended to be representative of a power induce noise spectral distribution. C-message weighting then relates the various component frequencies to their telephone interference importance.

3.4 Detector

3.4.01 The voltage Vm (Fig. 1) is fed to the balanced bridging input of a measuring circuit, which includes a quasi-rms detector circuit and a panel meter. A BALANCE attenuator switch sets the measuring circuit gain in 10 dB steps. Another gain step of 20 dB in ganged to the generator LEVEL switch so as to reduce the measuring set gain when the generator output is increased. This makes it possible to calibrate the measuring circuits so that the combination of meter scale reading and BALANCE switch setting shows balance in dB directly, where

$$\text{BALANCE} = 20 \log \frac{V_g}{V_m}$$

3.4.02 Also ganged to the GENERATOR switches is an active high pass filter in the detector circuits present only when making single frequency measurements in the upper range, 400 Hz to 4 kHz. This filter attenuates low frequency power induced noise received from the circuit-under-test, so that balance measurements can be made at higher frequencies in the presence of this noise.

3.5 DC Bias

3.5.01 A four-position DC BIAS switch is provided for each port. In the DC FEED position, the T and R terminals are connected through the balance resistors R1 and R2, the bias feed transformer, and a panel milliammeter to a DC supply which has an adjustable output voltage of zero to approximately 150 volts. Current is limited at 120 mA. The circuit will supply 120 mA to an external resistance of up to 450 ohms.

3.5.02 In the OFF position, the dc circuit is open and there is no dc current in that port.

3.5.03 In the DC TERM 750 ohms position, there is a dc path connecting the T and R terminals, through the balance resistors, the bias feed transformer, and the panel meter. The

total resistance of this path is approximately 750. In the DC TERM 2000 ohms position, a resistor is added in series with this path for a total dc resistance of approximately 2000 ohms.

> NOTE: These changes in dc terminating resistance do not affect the ac impedance, which remains 736 ohms, or the sum of the balance resistors R1 and R2, under all conditions.

3.5.04 The panel meter is connected inside a diode bridge so as to be polarity insensitive. (Current polarity at a port receiving dc current, in one of the DC TERM positions, is opposite to that at a port providing a current source in DC FEED.)

3.5.05 Each port in the T207 is provided with its own dc bias supply. These supplies are floating with respect to dc ground so that balanced bias current can be supplied to a circuit-under-test which may include a dc path to ground. Measurements may be made on circuits or devices which include dc connection to external batteries, provided that neither R terminal of the T207 is driven positive with respect to the corresponding T terminal, and that no terminal is driven more than 70 volts positive or negative with respect to ground. (The T207 is grounded through the third wire of the power cord.)

3.6 Calibration

3.6.01 The test set calibration procedure consists of adjusting both R1-R2 and R3-R4 for a precise match.

3.6.02 In the absence of hum or noise; if the CAL balance reading is at least 13 dB greater than the specimen balance reading, the specimen balance reading is accurate to ±1 dB.

3.7 Validation

3.7.01 The presence of hum and noise in the specimen under test can cause readings which are substantially poorer than the actual balance.

3.7.02 A PUSH TO VERIFY button is provided for checking the significance of hum and noise in the balance reading. Pushing this button turns off the internal longitudinal signal generator and increases the measuring circuit sensitivity.

3.7.03 Normally, turning off the generator should also remove the measured metallic voltage so that the meter pointer moves left. If, however, noise was a significant factor in the balance measurement, the increased sensitivity will cause the pointer to move right. In this case, it is known that the balance is better than the measured value.

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3.7.04 If the difficulty is due to low frequency power induction, better readings may be possible in the upper single-frequency range, where low frequencies are attenuated in the measureing circuit. Shielding of the device under test or orienting it in such a way that the induce voltage is minimized will also result in more accurate readings.

4.0 PANEL CONTROLS AND CONNECTIONS

4.1 General

4.1.01 This section describes the function of each switch, control, lamp and connector located on the front panel of the Model T207 Test Set.

4.0.02 This section is sub-divided into sections relating to power, common use, calibration, D.C. feed and balance measurements.

4.2 Power Related Controls and Connections

4.2.01 AC Power Receptacle - This is a 3-prong male plug recessed behind the front panel located in the lower right corner. The line cord supplied with the test set supplies AC power to the test set through this connection.

4.2.02 POWER Switch - This PUSH ON-OFF switch performs the power on-off function and gives an indication that power is being supplied to the test set.

4.2.03 2 AMP Fuse - The twist-lock fuse holder is located just above the AC Power Receptacle. This 2 ampere fuse provides protection to the test set.

4.3 Common Controls and Connections

4.3.01 General - This section describes those controls, switches and connections that may be used in all testing modes.

4.3.02 BALANCE TEST Switch - This switch is located at the lower center of the panel.

a. In the FWD position of this switch, the set is connected as shown in Fig. 1. In the REV position, the connections of Vg and the Longitudinal Termination are interchanged, and the Vm connection is moved to the second set of T and R terminals (T_L and R_L).

b. In the CAL position of this switch, the two pairs of T and R terminals are disconnected from the test circuits, and the driving test circuit is internally connected to the terminating test circuit. The generator level is set to 10 volts (regardless of the LEVEL switch setting) while the detector 20 dB gain step is set in the higher position (which normally goes with the 1 volt generator level). Thus, the actual balance of the T207 alone will be 20 dB better than the BALANCE reading obtained in the CAL position.

4.3.03 LEVEL 1V/10V Switch - This push switch is a portion of the SIGNAL controls located in the upper left section of the panel. The switch selects the longitudinal signal voltage level applied to the specimen and sets the proper detector gain for direct reading of BALANCE dB. This switch is interlocked with the BROADBAND switch to prevent selection of a 10V level with the broadband signal.

4.3.04 BROADBAND Switch - This switch is a portion of the SIGNAL controls located in the upper left section of the panel. When depressed, this switch selects the broadband signal as the longitudinal signal applied to the specimen and releases the SINGLE FREQ switch. The FREQUENCY-Hz display indicates 61 Hz. This switch is interlocked with the LEVEL switch to prevent selection of the broadband signal at a 10V level.

4.3.05 SINGLE FREQ Switch - This switch is a portion of the SIGNAL controls located in the upper left section of the panel. When depressed, this switch selects the single frequency displayed in the FREQUENCY-Hz as the longitudinal signal applied to the specimen and releases the BROADBAND switch.

4.3.06 40-400/400-4K - This push switch is a portion of the SIGNAL located in the upper left section of the panel. The switch selects the decade range of FREQUENCY-Hz tunable by the TUNING control.

4.3.07 TUNING Control - This control in conjunction with the 40-400/400-4K switch permits the selection of any frequency between 40 Hz and 4 kHz. The control has dual ratio tuning. Each range may be tuned by five (5) revolutions of the control. Vernier Tuning is provided by reverse tuning of the control.

4.3.08 FREQUENCY - Hz Display - Displays the frequency of the longitudinal signal. The display is updated two times per second.

4.3.09 BALANCE dB - This nine (9) position rotary switch is located in the upper center of the panel. It is a 10 dB step attenuator calibrated 10 dB to 90 dB.

4.3.10 METER - The meter is calibrated from +12 dB to -2 dB with subdivisions of 0.5 dB between +10 dB and -2 dB. The balance reading is the algebraic sum of the BALANCE dB switch setting and the meter reading. When the BALANCE TEST switch is in the CAL position, the balance reading is the algebraic sum of the switch setting and the meter reading plus 20 dB.

4.3.11 PUSH TO VERIFY - This momentary push button is located below the dB meter. When depressed, the switch turns off the longitudinal signal and increases the detector gain 13 dB.

4.3.12 GEN OUT 600 ohm - A 310 Jack 600 ohm output from the longitudinal signal generator.

4.3.13 MONITOR -A 310 jack connected to a point in the measuring circuit which permits listening to the metallic signal.

4.4 Calibration Controls

4.4.01 - General - This section describes the controls that are used in the test set calibration procedure.

4.4.02 BALANCE TEST Switch - See description in Section 4.3.02.

4.4.03 CAL - There are two controls located at the lower center of the panel. Each control is the fine adjust for the associated balance resistors, either the C.O. SIDE or the LINE SIDE. These controls are used only during the calibration procedure.

4.4.04 FROG - There are two switches, one located at the lower left and right sections of the panel, respectively. When switched, each FROG switch interchanges the position of the two 368 ohm balance resistors for the associated port (C.O. SIDE or LINE SIDE).

4.5 DC FEED Related Controls

4.5.01 General - This section describes the controls used to provide dc current to the specimen. One set of controls is associated with each port (C.O. SIDE or LINE SIDE) of the T207.

4.5.02 D.C. BIAS Switch - These four (4) position rotary switches are located at the left center and right center of the panel. The functions of each position are as follows:

1. D.C. FEED - In this position, the T and R or T_L and R_L terminals are connected through the associated balance resistors, bias feed transformer, and panel meter to a variable dc supply.

2. OFF - In this position, the dc circuit is open and there is no dc current path in the associated port.

3. D.C. TERM 750 ohm - In this position, there is a dc path connecting the T and R or T_L and R_L terminals through the associated balance resistors, bias feed transformer, and panel meter. The total dc resistance of the path is approximately 750 ohms.

4. D.C. TERM 2K - In this position, a resistor is added in series with the D.C. TERM 750 ohm path for a total dc resistance of approximately 2000 ohms.

4.5.03 DCV ADJUST - This control is located below the associated D.C. BIAS switch. When the switch is in the D.C. FEED position, this control varies the voltage of the dc supply from OV to approximately 150V.

4.5.04 DC BIAS Meter - This meter is located adjacent to the associated dc controls. The meter is calibrated from 0 to 120 milliamperes with subdivisions of 5 milliamperes. The meter displays the dc current flowing in the associated T207 port

4.6 Balance Measurement Related Controls and Connections

4.6.01 General - This section describes the controls and connections used to make balance measurements on single or two port specimens.

4.6.02 T-R-G - These three binding posts are located in the lower left section of the panel. The binding posts are the connecting points for the tip (T), ring (R), and ground (G) of a single port specimen or the central office side of a two port specimen.

4.6.03 T_L-R_L-G - These three binding posts are located in the lower right section of the panel. The binding post are the connecting points for the tip (T_L), ring (R_L), and ground (G) of the line side of a two port specimen.

4.6.04 TWO PORT - This switch, located in the center of the panel, selects the AC longitudinal termination for a two port specimen. In the SHUNT BAL position, the termination is a 2 kilohm resistor. In the SERIES BAL position, the termination is a direct connection to ground.

5.0 OPERATING INSTRUCTIONS

5.1 Power

5.1.01 For operation, connect the line cord, supplied with the test set, to the recessed male connector on the front panel. The other end may be plugged into any 115 volt three-wire convenience outlet. Power is supplied to the test set by pushing the POWER, PUSH ON-OFF switch. The integral lamp indicates that power is being supplied to the test set.

WARNING

TO AVOID MERCURY
RELAY DAMAGE
OPERATE SET IN
VERTICAL POSITION

5.2 Calibration

5.2.01 The calibration procedure consists of adjusting R1-R2 and R3-R4 (Fig. 1) for a precise match.

5.2.02 The procedure is performed in the following manner.

a. Select SINGLE FREQ signal.

b. Set the BALANCE TEST switch in the CAL position.

c. Adjust the CAL control for either port for a maximum balance (minimum Vm reading.

d. Throw the FROG switch for the same port; the meter will usually indicate a poorer balance.

e. Adjust the CAL control to bring the reading part way back to what it was.

f. Throw the FROG switch for the same port; the meter will usually indicate a better balance.

g. Continue to adjust the CAL control while operating the FROG switch until the best reading which is the same in both positions of the FROG switch is obtained.

h. Repeat the same procedure for the other port

i. Repeat again for each port until the optimum CAL balance is obtained.

5.2.03 The CAL balance reading is the algebraic sum of the BALANCE dB switch setting and the dB meter scale reading plus 20 dB (see Section 4.3.02 for explanation).

5.2.04 At 40 Hz the CAL balance should be 113 dB or greater. Over most of the frequency range, it should be possible to obtain a CAL balance reading of 107 dB or better.

5.2.05 The CAL balance reading actually shows the combined effect of test circuit unbalance, internal hum and noise, common-mode response of the measuring circuits, and any other factor internal to the T207 which could affect the balance reading.

NOTE: A practical calibration technique, when measuring specimens at various frequencies, is to perform the CALIBRATION procedure at 40 Hz (this minimizes internal T207 capacitance affect when determining a precise match for the balance resistors). The poorest CAL balance reading obtained with any combination of FROG switch position is then recorded as the test set CAL balance for each frequency of interest.

5.3 Balance Measurement - Single Port Specimen

5.3.01 For initial set-up, perform the CALIBRATION procedure of Section 5.2.

5.3.02 Connect the specimen tip, ring, and ground or appropriate corresponding connections to the T, R, and G terminals (SINGLE PORT) of the T207.

NOTE: Care should be taken in connecting the specimen to avoid inaccuracies caused by unbalance in the connecting wires. The T and R wires should be of equal lengths and tightly twisted.

5.3.03 Select the desired SIGNAL source, either BROADBAND or SINGLE FREQ, as the longitudinal test signal.

5.3.04 If SINGLE FREQ source is used, select the desired SIGNAL LEVEL; either 1V or 10V, for the longitudinal test signal.

NOTE: The specimen should be tested at both signal levels. If there is a difference in balance dB readings and noise is not a significant factor in either balance reading, susceptibility to signal level should be suspected.

5.3.05 When using SINGLE FREQ longitudinal signal, select the desired frequency RANGE and adjust the TUNING control until the desired frequency is displayed as FREQUENCY - Hz.

NOTE: The TUNING CONTROL has a dual speed drive to provide easier tuning with the two per second frequency display update rate.

5.3.06 When using BROADBAND longitudinal signal, the FREQUENCY - Hz display reads 61 and the signal level is set at 1V by the interlock between the LEVEL and BROADBAND switches.

5.3.07 Set the BALANCE TEST switch in the FWD position.

5.3.08 If the specimen requires bias current, the following steps must be completed. If bias current is not required, omit this section.

a. Set the DC bias switch to DC FEED.

b. Adjust the DCV ADJUST control until the DC BIAS meter indicates the desired current.

5.3.09 Adjust the BALANCE dB attenuator switch for an on-scale meter reading. The specimen balance will be the algebraic sum of the switch setting and the meter reading.

5.3.10 Throw the FROG switch associated with the SINGLE PORT T207 port; agreement of the balance reading with the reading in step 5.3.09 gives additional assurance of a properly performed calibration procedure.

5.3.11 Momentarily depress the PUSH TO VERIFY button; if hum or noise in the circuit under test is a significant factor, the dB meter pointer will move right. If the dB meter pointer moves left, hum or noise is having less than ±1 dB affect on the balance reading.

NOTE: In the absence of hum or noise, if the CAL balance reading is at least 13 dB greater than the specimen balance reading, the specimen balance reading is accurate to ±1 dB.

NOTE: The DATA SHEET provides a convenient method of recording the various test conditions and balance readings for individual specimens.

5.4 Balance Measurement - Two Port Specimen

5.4.01 For initial set-up, perform the CALIBRATION procedure of Section 5.2.

5.4.02 Set the BALANCE TEST switch to the CAL position; this electrically isolates the T-R and T_L -R_L terminals from the test set while the specimen is being connected.

5.4.03 Connect the tip, ring and ground for the central office side of the specimen to the T, R, and G terminals (C.O. SIDE) of the T207.

5.4.04 Connect the tip, ring, and ground for the line side of the specimen to the T_L, R_L and G terminals (LINE SIDE) of the T207.

NOTE: Care should be taken in connecting the specimen to avoid inaccuracies caused by unbalance in the connecting wires. The T-R and T_L-R_L connecting pairs should be of equal lengths and tightly twisted.

5.4.05 Select the desired SIGNAL source, either BROADBAND or SINGLE FREQ, as the longitudinal test signal.

5.4.06 If SINGLE FREQ source is used, select the desired SIGNAL LEVEL; either 1V or 10V, for the longitudinal test signal.

NOTE: The specimen should be tested at both signal levels. If there is a difference in balance dB readings and noise is not a significant factor in either balance reading, susceptibility to signal level should be suspected.

5.4.07 When using SINGLE FREQ longitudinal signal, select the desired frequency RANGE and adjust the TUNING control until the desired frequency is displayed as FREQUENCY-Hz.

5.4.08 When using BROADBAND longitudinal signal, the FREQUENCY-Hz display reads 61 and the signal level is set at 1V by the interlock between the LEVEL and BROADBAND switches.

5.4.09 Determine the specimen port for which a balance measurement is desired and set the BALANCE TEST switch to the appropriate position, e.g., FWD measures the balance of the C.O. SIDE of the specimen.

5.4.10 Select the TWO PORT switch position for the desired longitudinal termination.

a. SHUNT BAL - This position is a 2 kilohm resistor termination; unbalances in impedance to ground in the specimen are the predominant contributor to the measured metallic voltage and hence the balance reading.

b. SERIES BAL - This position is a direct connection to ground termination; unbalances in the series impedance of the specimen are the predominant contributor to the balance reading.

5.4.11 If the specimen requires bias current, the following steps must be completed. If bias current is not required, omit this section.

a. Select the T207 port from which DC current will be supplied, either the C.O. SIDE; or the LINE SIDE; set the associated DC BIAS switch to the D.C. FEED position.

b. Set the DC BIAS switch for the other port to the desired D.C. TERM position, e.g., 750 ohm or 2K.

c. Adjust the DCV ADJUST control for the D.C. FEED port to set the desired current as displayed by the DC BIAS meter.

5.4.12 Adjust the BALANCE dB attenuator switch for an on-scale meter reading. The specimen balance will be the algebraic sum of the switch setting and the meter reading.

5.4.13 Throw the FROG switch for the port selected by the BALANCE TEST switch; agreement of the balance reading with the reading in step 5.4.12 gives additional assurance of a properly performed calibration procedure.

5.4.14 Momentarily depress the PUSH TO VERIFY button; if hum or noise in the circuit under test is a significant factor, the dB meter pointer will move right. If the dB meter pointer moves left, hum or noise is having less than ±1 dB affect on the balance reading.

NOTE: In order to completely define the balance of a two port specimen, measurements must be made for both TWO PORT switch positions with the FWD and REV positions of the BALANCE TEST switch.

NOTE: In the absence of hum or noise, if the CAL balance reading is at least 13 dB greater than the specimen balance reading, the specimen balance reading is accurate to ±1 dB.

NOTE: The DATA SHEET provides a convenient method of recording the various test conditions and balance readings for individual specimens.

6.0 MAINTENANCE - TROUBLE LOCATING

6.1 General

6.1.01 All Wilcom Products, Inc. test equipment is warranted against defects in materials and workmanship for a period of one year from the date of delivery. Complete details of the warranty can be found on the title page of this manual.

6.1.02 Field repair of this test set is NOT recommended unless the repair will be made in a well equipped repair center. The technicians performing the repair should be familiar with digital circuitry, logic functions and state of the art semiconductor design.

6.1.03 In the event of troubles, it is important that the Operational Checks described in 6.2 thru 6.7, be performed BEFORE any attempts are made to repair the test set. By following this procedure, it can be determined if the problem is real or results from improper operation of the test set.

6.1.04 If the trouble cannot be found and corrected by following the procedures of 6.2 thru 6.7, reference should be made to the block diagram of Fig. 3-1, the circuit description of Section 3.0, and the detailed test procedures of Sestion 7.0. A competent technician with an understanding of the circuit functions should be able to trace signals and locate and repair any fault which may occur.

6.1.05 After any repairs, not made by Wilcom Products, Inc. the test set should be re-aligned. Section 7.0, Alignment and Calibration, describes the methods and equipment required. In most cases it will not be necessary to repeat the whole of this procedure, but only applicable portions.

6.2 Operational Checks, General

6.2.01 Location of trouble within the T207 can often be expedited by making a few simple operational tests. All of these tests can be done without removing the set from its case. More detailed tests are described in the Alignment and Calibration Procedure, 7.0.

6.2.02 The basic operational check for the T207 is accomplished by performing the calibration procedure of Section 5.2. At 40 Hz the CAL balance reading should be 113 dB or greater. Over most of the frequency range, it should be possible to obtain a CAL balance reading of 107 dB or better.

6.2.03 Should difficulty be encountered in performing the calibration procedure the following procedures will help locate the source of the trouble.

6.3 Noise Check

6.3.01 This procedure checks the internal noise level of the T207. Set controls as follows:

1.	SINGLE FREQ.	Engaged
2.	LEVEL	Released (1V)
3.	SINGLE FREQ: RANGE	Released (40-400 Hz)
4.	BALANCE dB	90
5.	BALANCE TEST	FWD
6.	DC BIAS	OFF
7.	TWO PORT	SHUNT

6.3.02 Be sure that there is nothing connected to, and no noise source close to, the measurement terminals (T,R,T_L, or R_L) of the T207.

6.3.03 Engage the PUSH TO VERIFY pushbutton and observe a meter reading of 90 or greater.

NOTE: During noise checks, if a dual-trace oscilloscope is available, it may be helpful to observe the signal at the GEN OUT jack with one trace and the detected voltage at the MONITOR jack with the other trace.

6.3.04 Set the BALANCE TEST switch to the REV position.

6.3.05 Engage the PUSH TO VERIFY pushbutton and observe a balance meter reading 90 dB or greater.

6.3.06 A poor balance dB reading of equal magnitude in the FWD and REV positions generally indicates trouble due to spurious signal developed in the preamplifier or detector circuits.

6.3.07 A poor balance dB reading in either the FWD or REV position, but not both, generally indicates that either the nulling amplifier for the corresponding balance circuit is acting as a noise source or the bias power supply is a noise source.

6.4 DC Bias Check

6.4.01 This procedure checks the dc bias supplies and the basic functional operation of the frogging relays. Set controls as follows:

1.	SINGLE FREQ.	Engaged
2.	LEVEL	Released (1V)
3.	SINGLE FREQ: RANGE	Released (40 to 400 Hz)
4.	BALANCE dB	20
5.	BALANCE TEST	CAL
6.	DCV ADJUST (C.O. SIDE)	Counterclockwise
7.	DC BIAS (SIDE)	DC FEED
8.	DCV ADJUST (LINE SIDE)	Counterclock
9.	DC BIAS (LINE SIDE)	750 Ω DC TERM

6.4.02 Adjust the C.O. SIDE: DCV ADJUST for a DC BIAS meter reading of 60 milliamperes. Both DC BIAS meters should read 60 mA ±2%. Set the frogging switches to all possible combinations and observe the current readings remain at 60 mA.

6.4.03 If either DC BIAS meter indicates other than 60 mA, it may be assumed that one frogging relay is not switching properly.

6.4.04 If no DC BIAS current is obtainable, trouble is indicated in the BIAS POWER SUPPLY.

6.4.05 Set the DC BIAS switch for the C.O. SIDE to 750 Ω DC TERM and the DC BIAS switch for the LINE SIDE to DC FEED.

6.4.06 Adjust the LINE SIDE: DCV ADJUST for DC BIAS meter reading Of 60 mA. Both DC BIAS meters should read 60 mA ±2%.

6.5 FWD/REV Balance Check

6.5.01 This procedure checks the FWD or REV Balance Test functions by going through the normal measurement procedure with a pair of resistors. Low value (e.g. 10 ohms) resistors are used in order to obtain a high balance reading with easily attainable resistance tolerance. For instance, the calculated balance for a pair of resistors of 10.0 ohms and 10.1 ohms (1% Δ R) is 72 dB, while the calculated balance for a pair of resistors of 600 and 606 ohms (again 1% Δ R) is only 53 dB. The actual balance of the test resistor pair is not important, but it should be high.

6.5.02 Set the controls as follows:

1.	SINGLE FREQ.	Engaged
2.	LEVEL	Released (1V)
3.	SINGLE FREQ: RANGE	Released (40 to 400 Hz)
4.	FREQUENCY - Hz	100 Hz
5.	BALANCE dB	20
6.	BALANCE TEST	FWD
7.	DC BIAS	OFF
8.	TWO PORT	SHUNT

6.5.03 Connect a 10 ohm, one percent resistor between the C.O. SIDE T and G terminals. Connect a 10 ohm, one percent resistor between the C.O. SIDE R and G terminals.

6.5.04 Set the BALANCE dB switch to obtain an on-scale meter reading. It should be possible to obtain an equal BALANCE dB reading in either position of the associated FROG switch. The associated CAL control may require adjustment to obtain the equal readings. With a test resistor pair having a balance of between 80 and 90 dB, the CAL control should have a range of approximately 1.5 dB.

6.5.05 Set the BALANCE TEST switch to the REV position and connect the 10 ohm resistors to the LINE SIDE terminals. BALANCE dB readings, identical to those of step 6.5.04, should be obtained for either position of the associated FROG switch.

6.6 Generator Check

6.6.01 This procedure checks the generator output and the Vg switching to the external terminal. Set controls as follows.

1.	SINGLE FREQ.	Engage
2.	LEVEL	Released (1V)
3.	SINGLE FREQ: RANGE	Released (40 to 400 Hz)
4.	FREQUENCY - Hz	100 Hz
5.	BALANCE dB	20
6.	BALANCE TEST	FWD
7.	DC BIAS	OFF
8.	TWO PORT	SHUNT

6.6.02 Using an oscilloscope, observe the signal at the GEN OUT 600 Ω jack. It should be sinusoidal, with an amplitude of 1V rms. Observe that the amplitude and waveform are constant over the two tuning ranges, 40 Hz to 400 Hz and 400 Hz to 4 kHz. Also observe that the signal disappears when the PUSH TO VERIFY button is pushed.

6.6.03 Engage the LEVEL pushbutton. The level at the GEN OUT jack increases to 10 V rms.

6.6.04 Using an oscilloscope, observe a 10 V rms sine wave between the T and G terminals, and between the R and G terminals.

6.6.05 Set the BALANCE TEST switch to the REV position. The 10 V rms signal is no longer present at the C.O. or SINGLE PORT terminals. Observe the 10 V rms signal is now between the T_L and G terminals and between the R_L and G terminals.

6.6.06 No signal at the GEN OUT jack indicates failure in the oscillator, PUSH TO VALIDATE switch, or the output amplifier. No signal at the C.O. or LINE terminals indicates trouble in the Balance Circuit Assembly (0207-01-039), (A1).

6.7 Detector Check

6.7.01 This procedure checks the detector and its switching to the external terminals. Set controls as follows:

1.	SINGLE FREQ.	Engaged
2.	LEVEL	Released (1V)
3.	SINGLE FREQ: RANGE	Released (40 to 400 Hz)
4.	FREQUENCY - Hz	100 Hz
5.	BALANCE dB	20
6.	BALANCE TEST	FWD
7.	DC BIAS	OFF
8.	TWO PORT	SHUNT

ADJUSTMENT PROCEDURE 7-7- METER SCALE ADJ

6.7.02 Connect both an ac voltmeter and an oscillator across the T and R terminals (C.O. SIDE). The oscillator frequency should be set to 1000 Hz.

6.7.03 While holding the PUSH TO VERIFY pushbutton to disable the internal generator in the T207, adjust the external oscillator for a voltmeter reading of 22.5 mV rms.

6.7.04 With the PUSH TO VERIFY pushbutton engaged, and the BALANCE dB switch set at 20, the meter should read 0 dB ± .5 dB.

6.7.05 Set the BALANCE dB switch to the 10 dB position and engage the PUSH TO VERIFY pushbutton. The BALANCE dB meter indicates 10 dB ± .5 dB.

6.7.06 Engage the LEVEL pushbutton (10V). Adjust the oscillator for a voltmeter reading of 225 mV rms and a frequency of 1000 Hz while holding the PUSH TO VERIFY pushbutton engaged.

6.7.07 Set the BALANCE dB switch to 20 dB and engage the PUSH TO VERIFY pushbutton. The BALANCE dB meter again indicates 0 dB ± .5 dB.

6.7.08 Set the BALANCE dB switch to the 10 dB position and engage the PUSH TO VERIFY pushbutton. The BALANCE dB meter indicates 10 dB ± .5 dB.

6.8 Repair Procedure

6.8.01 The Operational Checks of 6.2 through 6.7 should give a good indication of trouble location. Table 6-1 provides a cross reference to associate the operational checks with the related schematic and assembly drawings as well as the alignment Procedures. The next step is to remove the Test Set from its case.

CAUTION
DO NOT REMOVE ANY SCREWS FROM THE FRONT PANEL

Remove three screws from the top and three screws from the bottom of the case. Grasp the set by the front panel handles and pull it from the case.

6.8.02 The calibration controls are accessible without further disassembly of the Test Set. If detailed troubleshooting is required, the rear tray must be removed.

6.8.03 Power Support Tray Assembly Removal

1. Remove one flat head screw holding the center support bracket to the standoff on the Balance Circuit P.C. Assembly.

2. Remove the four flat head screws holding the tray to the two outer support brackets.

3. Remove the two screws holding the center support bracket to the front panel.

4. Being careful to avoid damaging the input connections to the bottom of the Balance Circuit, slide the tray to one side and then out the rear of the main assembly between the two side brackets.

WARNING

Short lenths of twisted wire are used to capacitively balance the circuitry at 4000 Hz. Altering the wires may require factory recalibration of the T207.

Operational Check	Alignment Section	Figure Number
Section 6.3	Sections 7.9,7.10 Section 7.7.07	Balance Circuit Fig. 8-13, 14 Preamplifier Fig. 8-3,4
Section 6.4	Section 7.8	Bias Power Supply Fig. 8-11, 12
Section 6.5	Sections 7.9,7.10	Balance Circuit Fig. 8-13, 14
Section 6.6	Sections 7.4,7.5	Oscillator Fig.8-1, 2 Output Amplifier Fig 8-5, 6
Section 6.7	Section 7.7	Meter Circuit Fig. 8-7, 8

Table 6-1

7.0 ALIGNMENT AND CALIBRATION

7.1 General

7.1.01 This section provides information needed to align the Model T207 Longitudinal Balance Test Set and verifies the proper operation of the Set. Alignment information covers adjustments which can be made by field personnel, using standard test equipment.

7.1.02 The Operational Checks in Section 6 should be preformed BEFORE any attempt is made to calibrate the Test Set. Malfunctions uncovered should be repaired prior to completion of this procedure.

7.1.03 Applying Power — To eliminate repetitive instructions, it is assumed that power will be removed from the T207 during all disassembly or assembly operations and reapplied prior to testing. Allow 5 minutes for circuit to stabilize each time power is applied.

7.1.04 The Test Set should be removed from its case before starting the Alignment and Calibration procedure. See Section 6.8.

7.2 Equipment Required

1. Electronic ac voltmeter or Level Meter accurate to within ±.2 dB from 30 Hz to 4 kHz.
2. Digital Multimeter
3. General purpose oscillator — 30 Hz to 4 kHz; low output impedance.
4. Frequency Counter
5. Resistor: 450Ω, 10W
6. Precision Resistance Measuring Bridge

7.3 Power Supply Voltages

1. Using the dc voltmeter, check the following voltages on the terminal strip located below the front panel card cage.

Wire Color	Voltage
White	Common (±15V)
Red	+15V; ±.5V

Wire Color	Voltage
Black	-15V; ±.5V
Grey	Common (+5V, +8.5V)
Green	+5V; ±.2V
Wh/Green	+8.5V; +1.4V

7.4 Generator Output Level Adjust

7.4.01 Set the T207 controls as follows:

1. LEVEL	Released
2. SINGLE FREQ	Engaged
3. RANGE	400-4k (Engaged)
4. DC BIAS	OFF
5. BALANCE TEST	FWD

7.4.02 Adjust the SINGLE FREQ:TUNING control for a displayed GENERATOR:FREQUENCY-Hz of 1000 Hz.

7.4.03 Connect a high impedance ac voltmeter between the SINGLE PORT T and G terminals. The voltmeter should read 1 Vrms ±.02V. Adjust R22 (Amplitude) on the Oscillator and C-Message P.C. Assembly to obtain the required accuracy.

7.4.04 Engage the LEVEL pushbutton (10V). The ac voltmeter should read 10 Vrms ±.2V.

7.5 Harmonic Distortion Adjust

7.5.01 Replace the ac voltmeter at the SINGLE PORT T and G terminals with a distortion analyzer. Adjust R12 (Harmonic Distortion) for minimum distortion at 1 kHz.

7.5.02 The distortion should remain greater than 50 dB below the fundamental over the full frequency range. R12 may be re-adjusted if required.

7.6 Frequency Display Check

7.6.01 Replace the distortion analyzer at the SINGLE PORT T and G terminals with a frequency counter.

7.6.02 Engage the RANGE pushbutton (400-4k) and adjust the GENERATOR TUNING control fully CW. The T207 FREQUENCY-Hz display should indicate greater than 4000 and agree with the frequency counter ±1 count.

7.6.03 Adjust the TUNING control fully CCW. The T207 FREQUENCY-Hz display should indicate less than 400 and agree with the frequency counter ±1 count.

7.6.04 Release the RANGE pushbutton (40-400) and verify the tuning limits beyond 40 Hz and 400 Hz.

7.7 Meter Scale Adjust

7.7.01 Disconnect plugs P18,19,20 & 21 from the p.c. assemblies in the card cage. The oscillator and output amplifier circuits for the generator are removed to eliminate the generator signal at the tip and ring.

7.7.02 Connect an oscillator and ac voltmeter to the C.O. SIDE T and R terminals. Set the T207 controls as follows:

SIGNAL:LEVEL	Engaged (10V)
BALANCE dB	20
BALANCE TEST	FWD
DC BIAS	OFF (two switches)

7.7.03 Set the oscillator for a frequency of 1000 Hz at a .251 Vrms level. Adjust R14 (+12 dB Adjust) for a T207 meter indication at the left end picket (+12 dB).

7.7.04 Set the oscillator to 1000 Hz at 1 Vrms. Adjust R20 (Scale Adjust) for a T207 meter indication of 0 dB.

7.7.05 Set the BALANCE dB switch to the 10 position and observe a T207 meter indication at +10 dB. Repeat steps 7.7.03 and 7.7.04 to obtain the desired accuracy.

7.7.06 Set the oscillator to 1000 Hz at 0.1 Vrms and release the LEVEL pushbutton (1V). With the BALANCE dB switch set to the 10 position, the T207 meter indicates 0 dB ±.25 dB.

7.7.07 BALANCE dB Attenuator Check — Adjust the oscillator output level and BALANCE dB switch to the settings indicated in the following table. The T207 meter should indicate 0 dB ±.25 dB for each setting with the LEVEL pushbutton engaged (10V).

BALANCE dB switch	ac input voltage
20	1
30	.316
40	.1
50	.0316
60	.01
70	.00316
80	.001
90	.000316

7.7.08 Connect plugs P18,19,20 and 21 to their p.c. assemblies.

7.8 D.C. BIAS Current Limit

7.8.01 Meter Shunt — Units having serial number 47 or lower use external resistive shunts for the dc BIAS meters. Accuracy of the shunt is verified in the following manner.

1. Connect a 450 ohm, 10W resistor in series with a dc ammeter between the C.O. SIDE T and R terminals.

2. Set the T207 controls as follows:

DCV ADJUST	CCW
DC BIAS Switch	D.C. FEED
BALANCE TEST	FWD

3. Adjust the DCV ADJUST knob for an 80 milliampere indication on the ammeter. The T207 C.O. SIDE DC BIAS meter should read 80 mA ±1.6 mA.

4. Verify that the T terminal is positive in relation to the R terminal.

5. The accuracy of the LINE SIDE bias meter shunt is verified in a similar manner by connecting the resistor and ammeter to the T_L and R_L terminals and setting the T207 controls as following:

DCV ADJUST	CCW
DC BIAS Switch	D.C. FEED
BALANCE TEST	REV

6. Verify that the T_L terminal is positive in relation to the R_L terminal.

7.8.02 Current Limit — Operation of the current limit in the dc bias power supplies is verified in the following manner.

1. Connect a 450 ohm, 10W resistor in series with a dc ammeter between the C.O. SIDE T and R terminals and set the T207 controls as follows:

DCV ADJUST	CCW
DC BIAS Switch	D.C. FEED
BALANCE TEST	FWD

2. Adjust the DCV ADJUST knob to increase the ammeter reading until a drop is observed in the T207 meter reading. The T207 should provide approximately 125 mA before the current is limited.

3. Resistor R16 in the Bias Power Supplies is a selected value for the current limit. Decreasing R16 will increase the limit current.

4. The operation of the LINE SIDE current limit is verified in a similar manner with the BALANCE TEST switch in the REV position. The resistor and ammeter are connected to the T_L and R_L terminals.

7.9 Balance Resistance Matching

7.9.01 An internal padding resistor may be required to match each balance resistor pair within .025 ohms to allow "overlapping" resistance when the CAL control is adjusted.

7.9.02 The balance resistor pair matching is checked by performing the calibration procedure at 40 Hz. If a maximum balance point can be obtained with both CAL controls for each position of the frogging switches, the resistor pairs are matched to the required accuracy.

7.9.03 The following steps will provide a guide to select a padding resistance for matching each pair of balance resistors.

WARNING

Short lengths of twisted wire are used to capacitively balance the circuitry at 4000 Hz. Altering the twisted pairs may require factory recalibration of the T207.

1. Remove the Balance Circuit P.C. Assembly from the front panel.

CAUTION

The p.c. assembly must be oriented to maintain the relays in a vertical position for proper mercury wetting action.

2. Using a precision resistance meter, measure the resistance between terminals E13 and E14 and compare to the resistance measured between E15 and E16.

3. Select the resistance required to reduce the higher reading to match the lower within the required accuracy.

4. Repeat steps 2 and 3 for the resistor pair between terminals E17, 18, and E19, 20.

5. Reinstall the Balance Circuit P.C. Assembly to the front panel and perform the calibration procedure at several frequencies. At 40 Hz the CAL balance should be 113 dB or greater. It should be possible to obtain a CAL balance of 107 dB or better over most of the frequency range.

7.10 Nulling Amplifier Offset

7.10.01 The nulling amplifier offset is balanced to improve dc stability. The following table indicates the dc reference points and select resistors for both amplifiers on assembly A1. The offset voltage should be approximately -1 volt when measured with a high impedance dc voltmeter.

Amp	Voltage Ref. Point	Voltage Meas. Point	Select Res.
U1	U1 pin 3	junction of CR1/R74	R84,85
U2	U2 pin 5	junction of CR2/R62	R82,83

7.11 Two Port Termination Check

7.11.01 Remove plug P25 from the Balance Circuit P.C. Assembly.

7.11.02 Using an ohmeter, verify the proper resistance between P25 pin 2 and ground for both positions of the TWO PORT switch.

SHUNT BALANCE	2000 ohms
SERIES BALANCE	0 ohms

7.12 Broadband Level Adjust

7.12.01 The broadband level is set by using the calibrated single frequency level as a reference.

1. Perform the calibration procedure at 100 Hz.
2. Refer to section 6.5 and perform the Balance check 6.5.01 to 6.5.04.
3. Note the Balance dB reading.
4. Engage the SIGNAL:BROADBAND pushbutton. The FREQUENCY Hz displays 61.
5. Adjust R36 (Broadband) on the Oscillator and C-Msg P.C. Assembly to obtain the Balance dB reading noted in step 3.

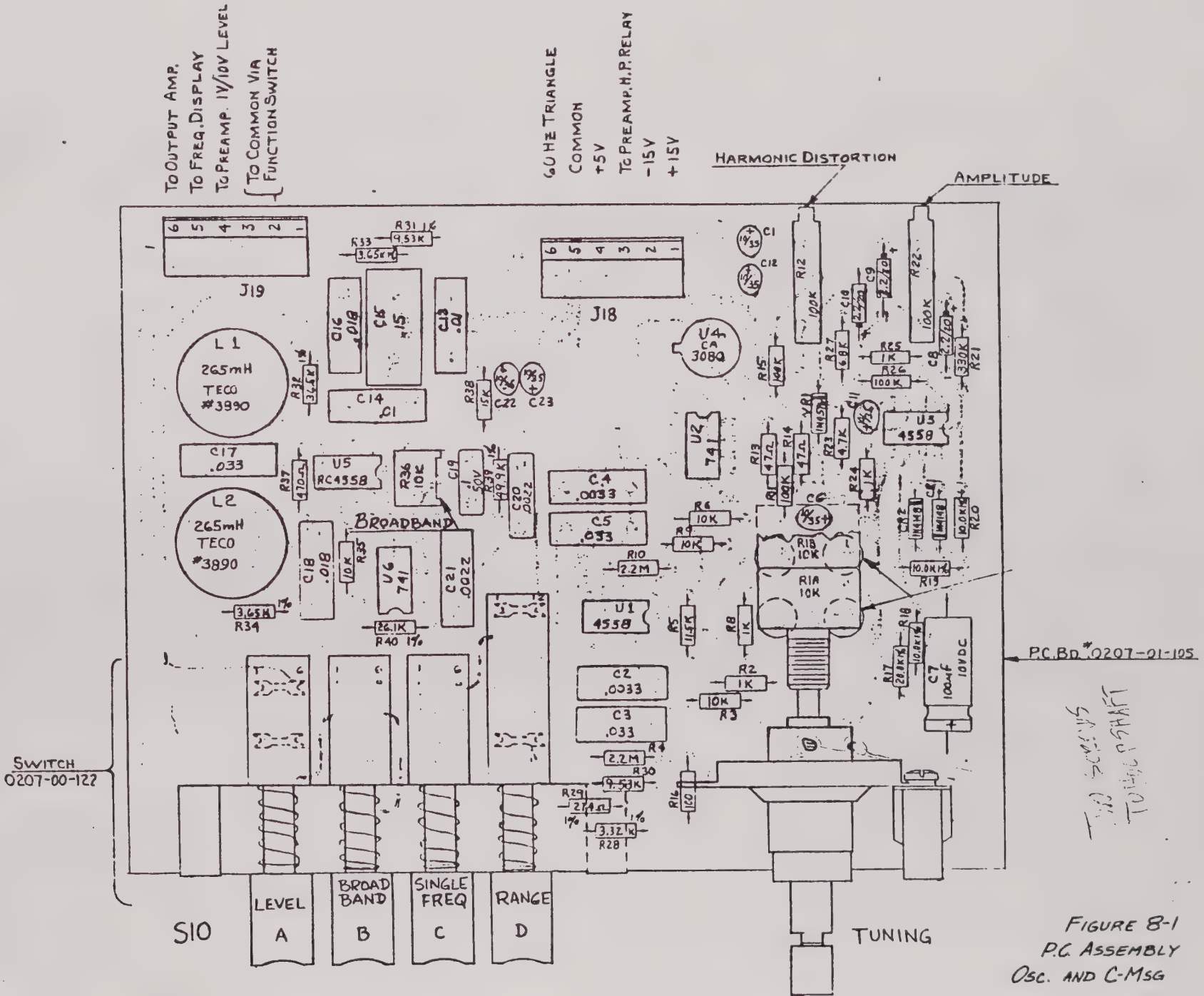
8.0 SCHEMATIC AND LAYOUT DRAWINGS

8.1 General

8.1.01 The following pages provide the drawings useful in locating and identifying the various assemblies that make up the Model T207 Longitudinal Balance Test Set.

8.1.02 The necessary schematic diagrams and layout drawings of each sub-assembly are given to allow identification of various components, controls and terminals on the circuit boards. This information will be useful to those with the facilities to provide maintenance and calibration of the T207.

8.1.03 This section contains Figure 8-1 through 8-14. The titles of these figures are given in the Table of Contents.


TO OUTPUT AMP.
TO FREQ. DISPLAY
TO PREAMP. 1V/10V LEVEL
TO COMMON VIA FUNCTION SWITCH
60 HZ TRIANGLE
COMMON
+5V
TO PREAMP. H.P. RELAY
-15V
+15V
HARMONIC DISTORTION
AMPLITUDE
J19
J18
L1
265mH
TECO
#3890
L2
265mH
TECO
#3890
BROADBAND
U4
CA
3080
U5
RC4558
U6
741
U2
741
U3
4558
U1
4558
R1A
10K
R1B
10K
P.C. BD. #0207-01-105
SWITCH
0207-00-122
S10
LEVEL
A
BROAD
BAND
B
SINGLE
FREQ
C
RANGE
D
TUNING
FIGURE 8-1
P.C. ASSEMBLY
OSC. AND C-MSG

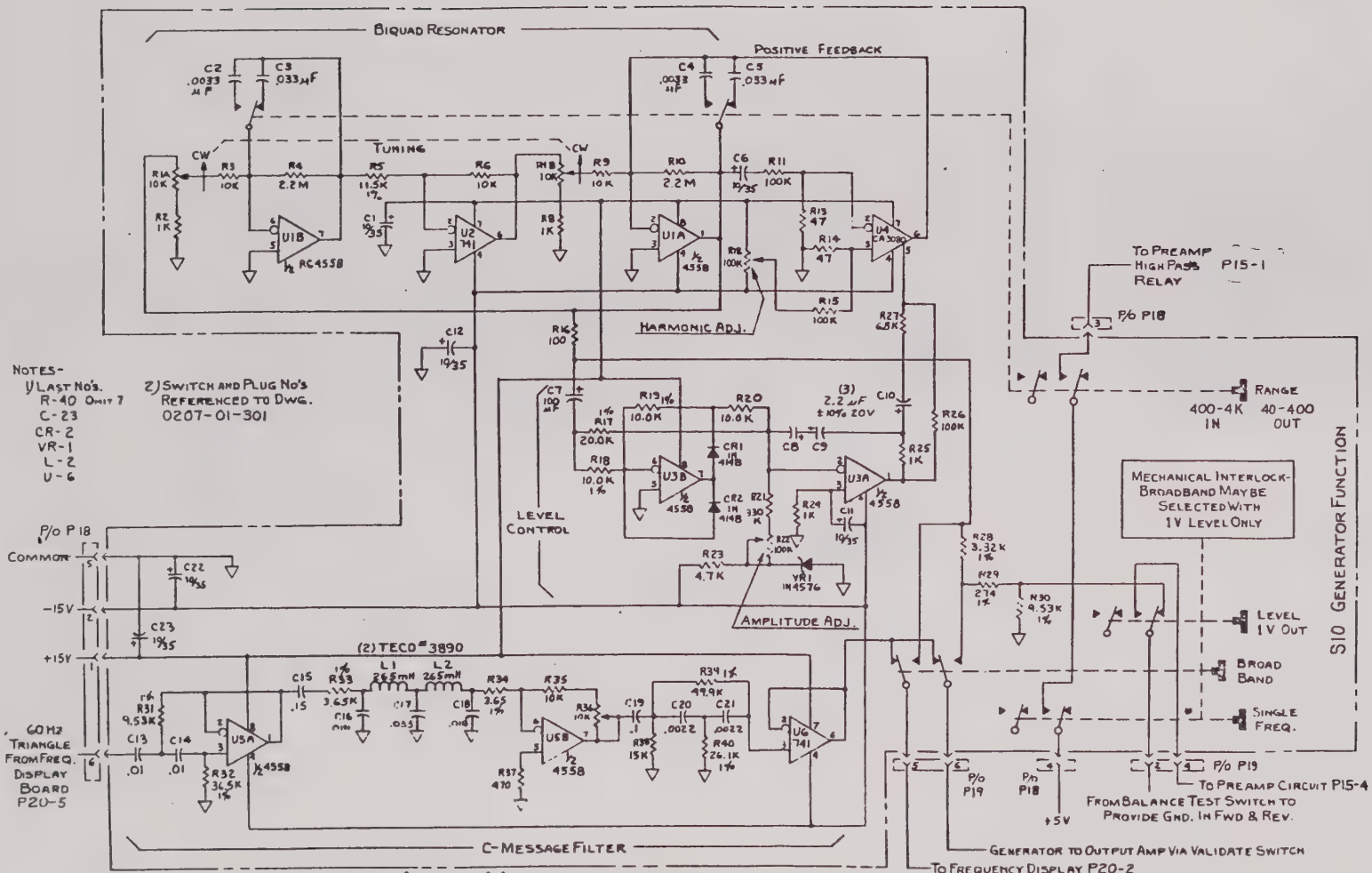


FIGURE 8-2
SCHEMATIC
OSCILLATOR AND C-MS

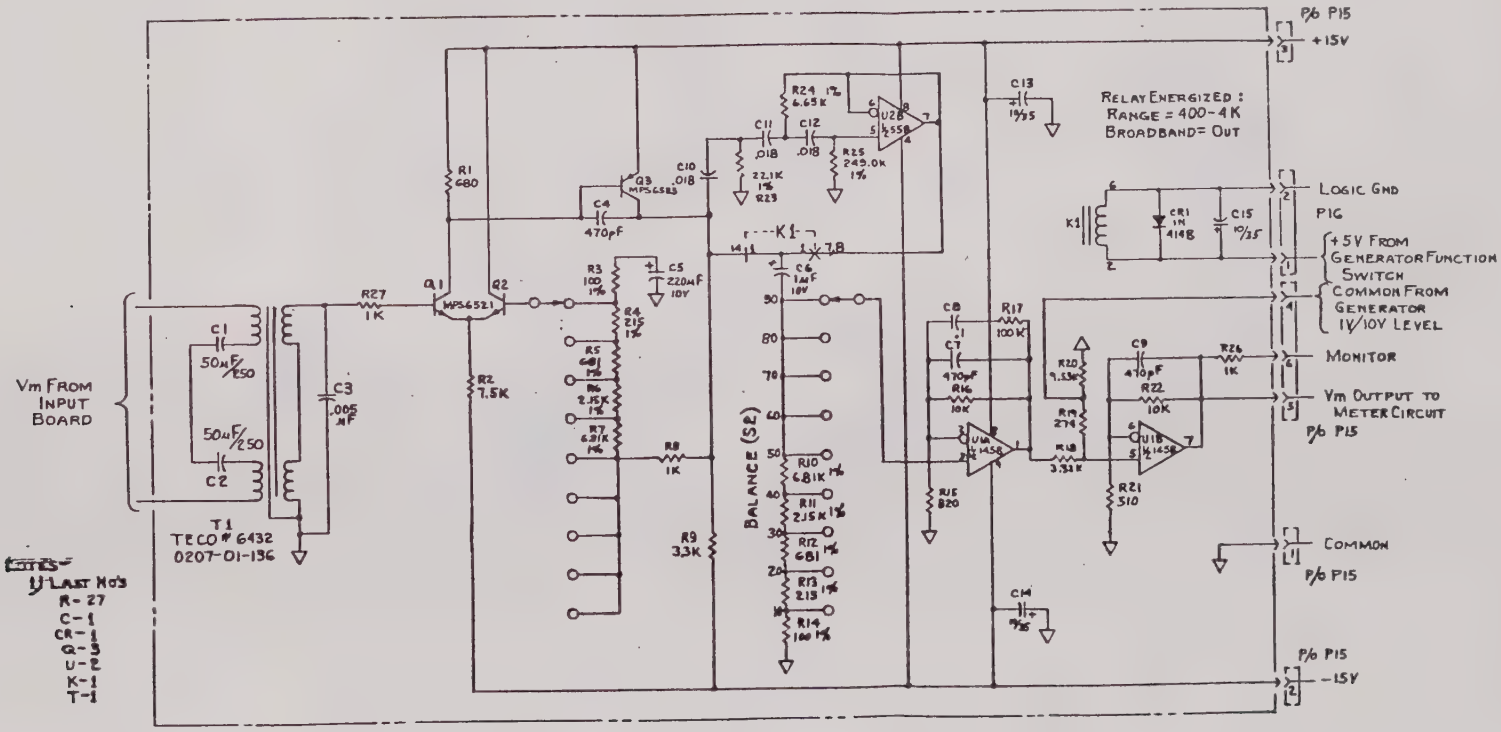


FIGURE 8-3
SCHEMATIC
PREAMPLIFIER AND ATTENUATOR

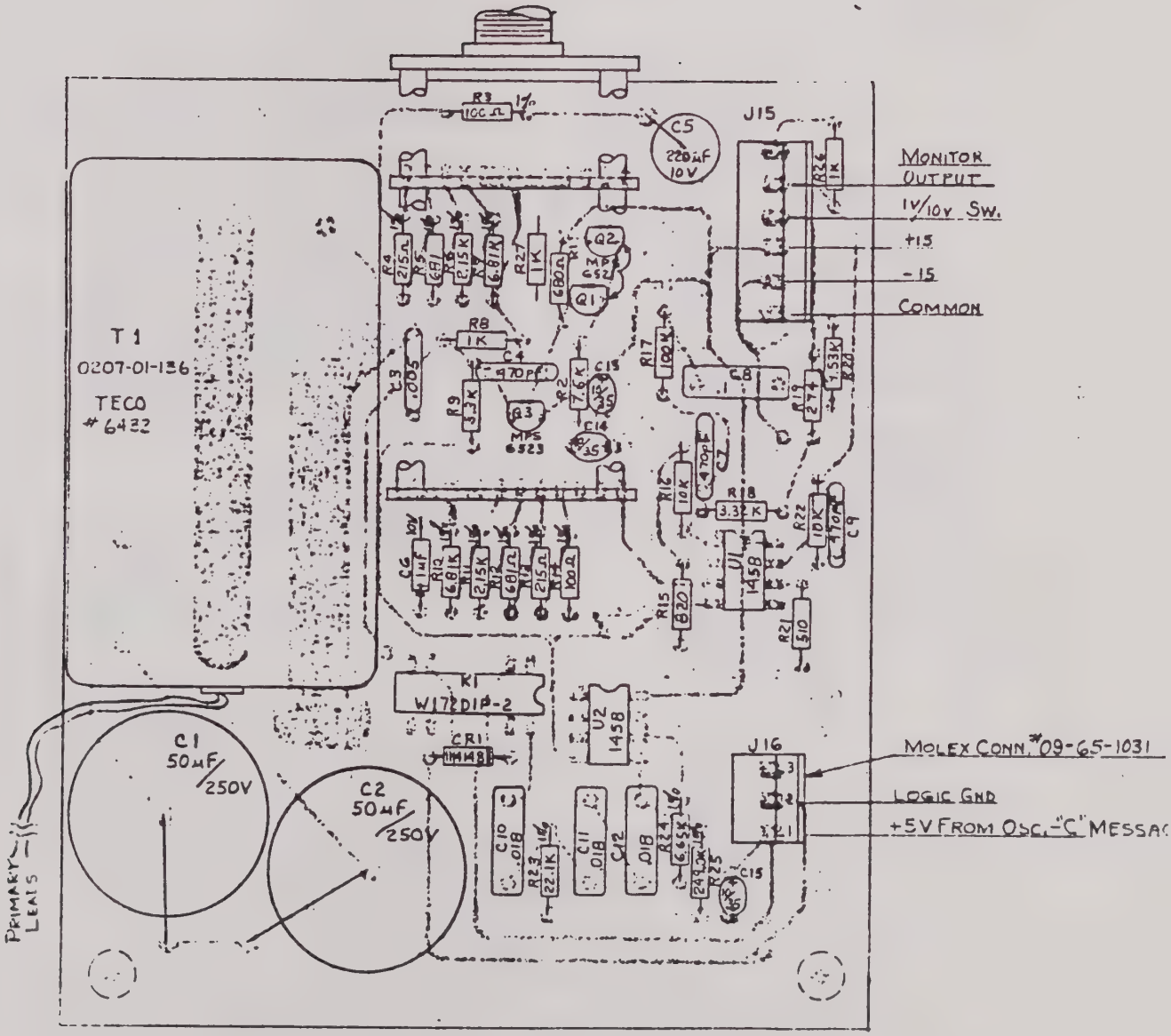


FIGURE 8-4
P.C. ASSEMBLY
PREAMPLIFIER AND ATTENUATOR

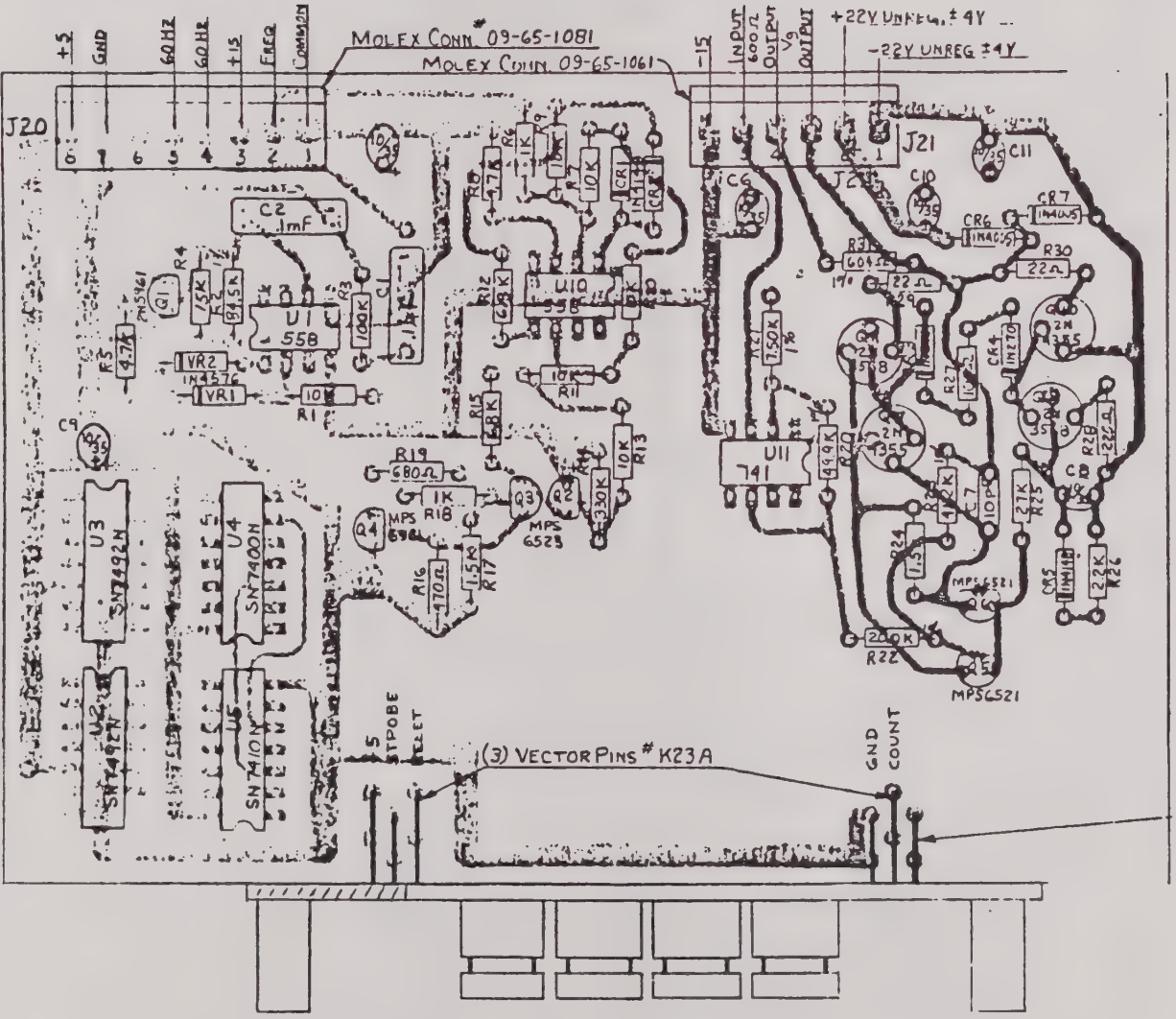
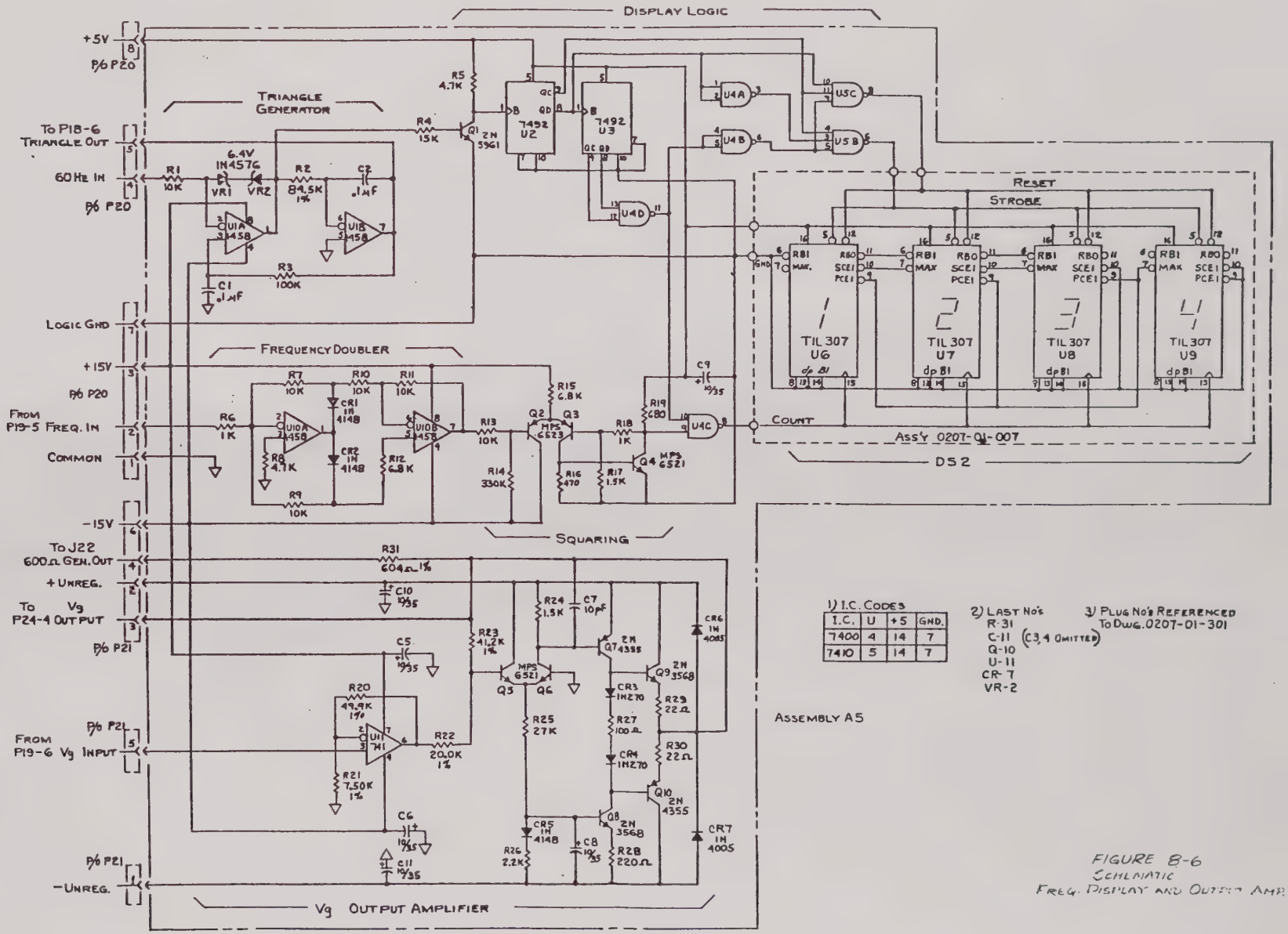


FIGURE 8-5
P.C. ASSEMBLY
FREQ. DISPLAY AND OUTPUT AMP.



1) I.C. CODES

I.C.	U	+5	GND.
7400	4	14	7
7410	5	14	7

2) LAST No's
R-31
C-11 (C3,4 OMITTED)
Q-10
U-11
CR-7
VR-2

3) PLUG No's REFERENCED TO DWG. 0207-01-301

ASSEMBLY A5

FIGURE 8-6
SCHEMATIC
FREQ. DISPLAY AND OUTPUT AMP.

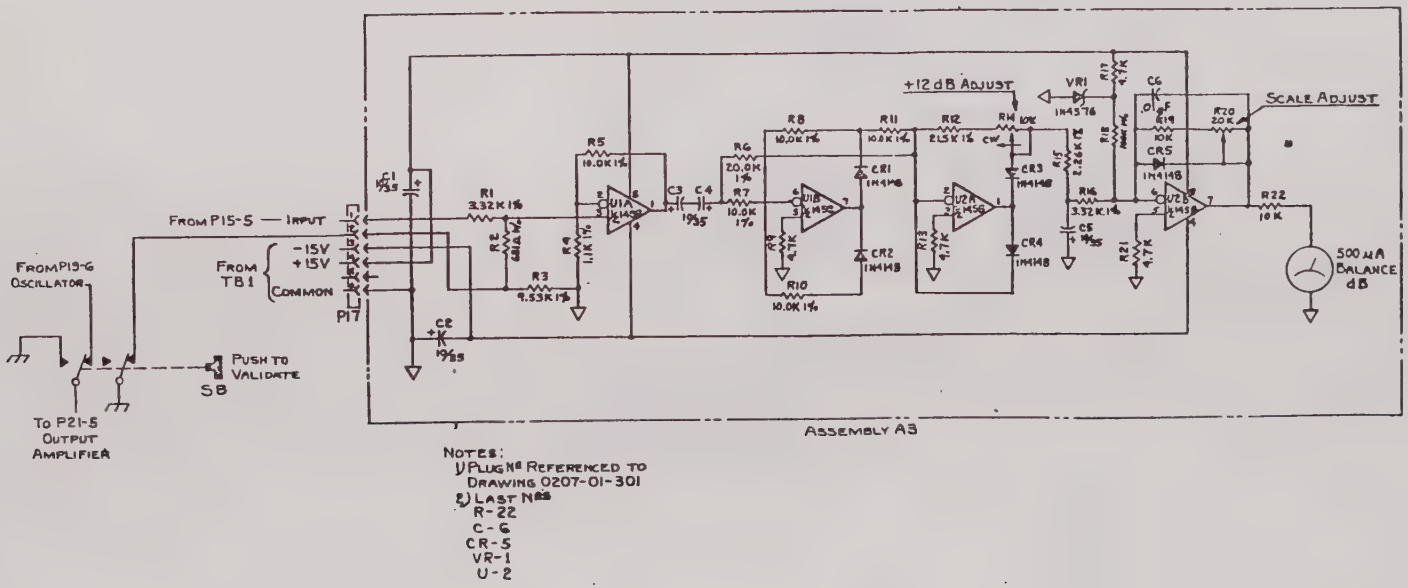


FIGURE 8-7
SCHEMATIC
METER CIRCUIT

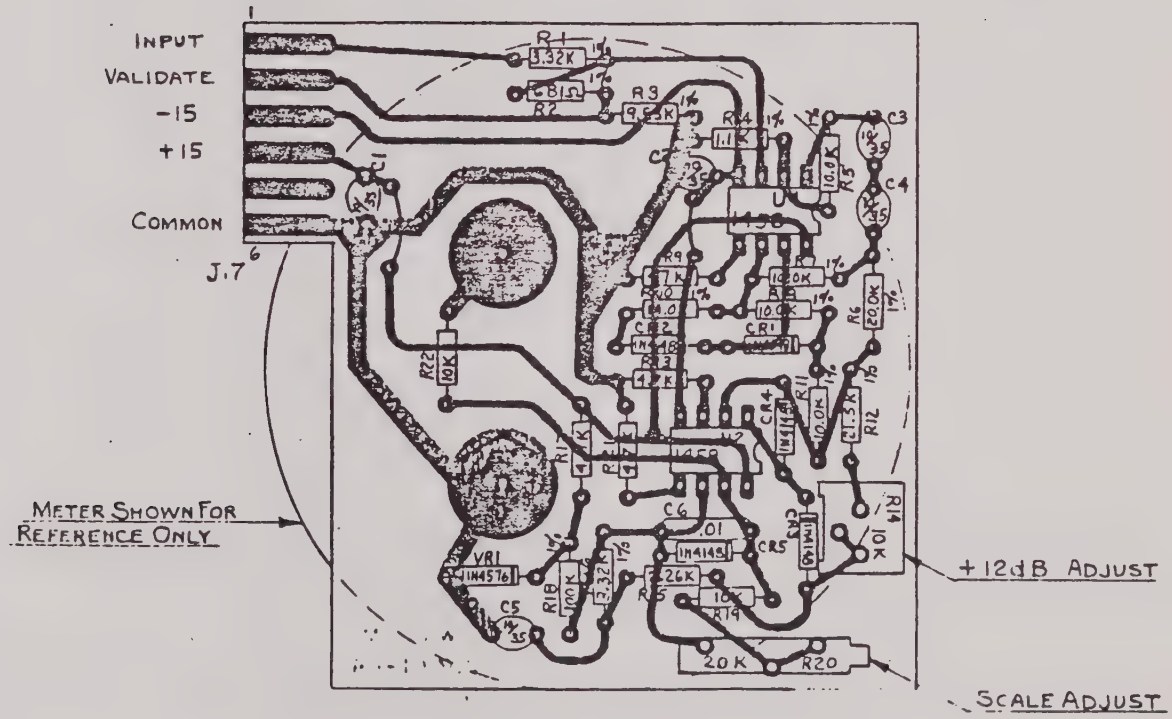
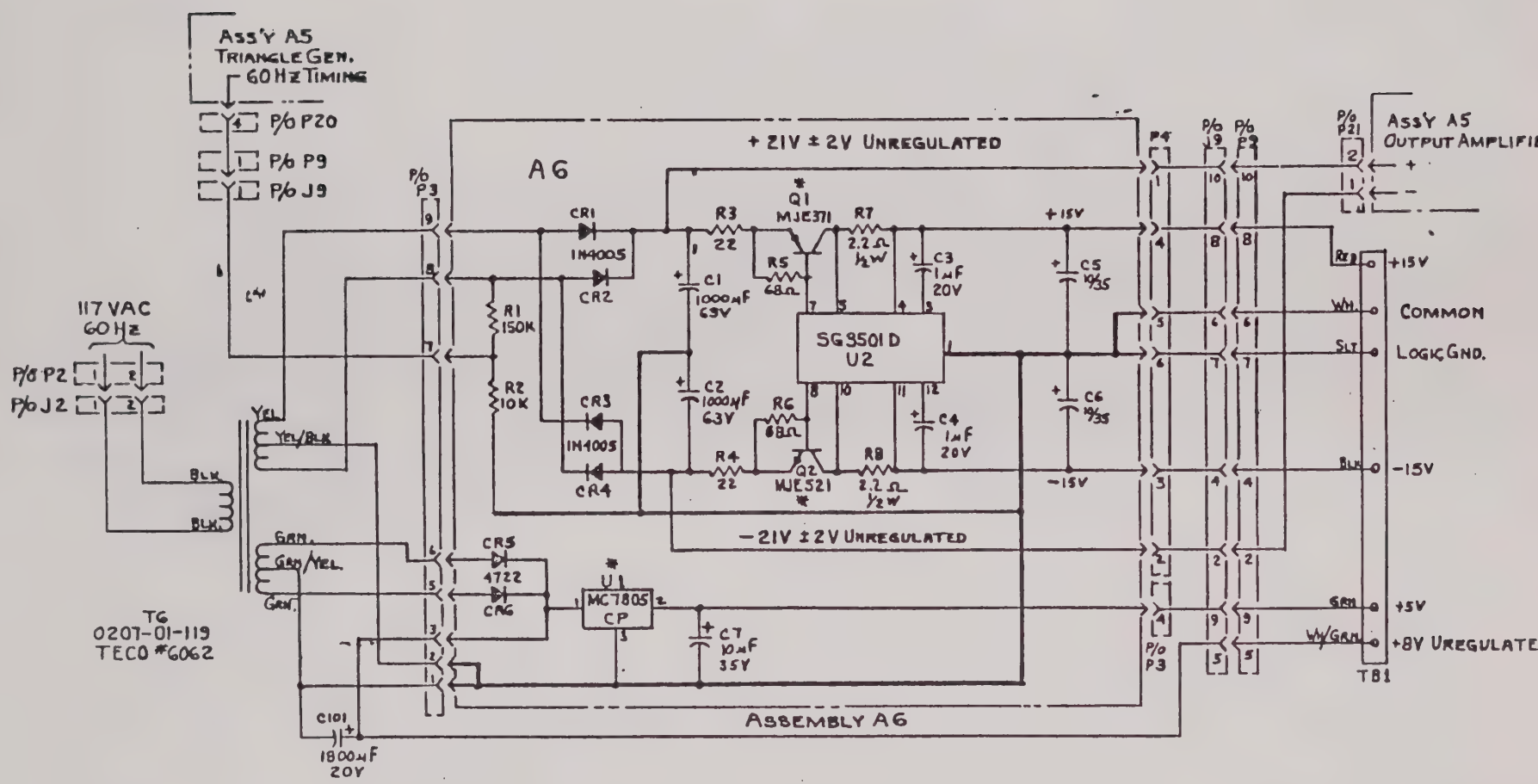


FIGURE 8-8
SCHEMATIC
METER CIRCUIT



NOTES-

1) TRANSFORMER & PLUG No's REFERENCED TO DWG. 0207-01-301

2) * U1, Q1-2 MOUNTED ON HEAT SINK/SUPPORT BRKT

3) LAST No's
R - 8
C - 7
CR - 6
Q - 2
U - 2

FIGURE 8-9
SCHEMATIC
SET POWER SUPPLY

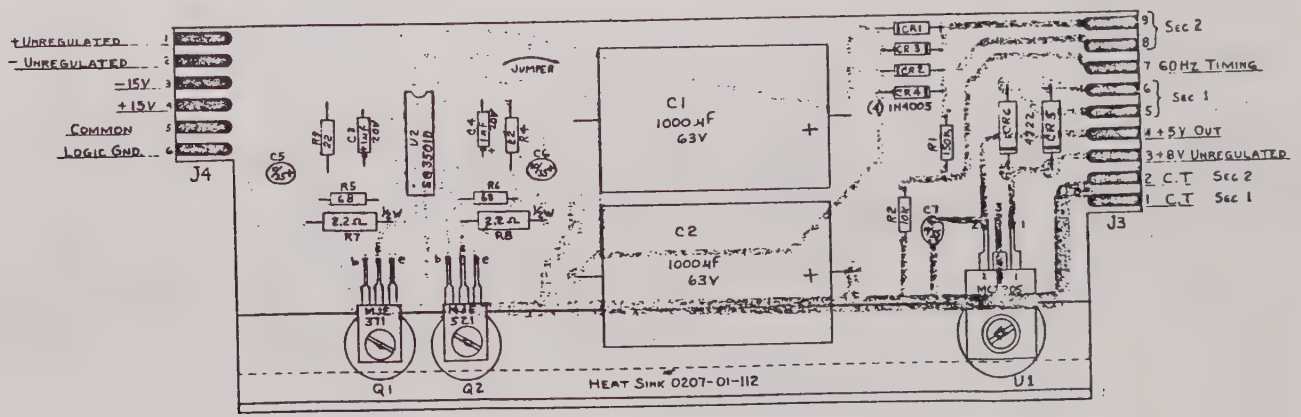
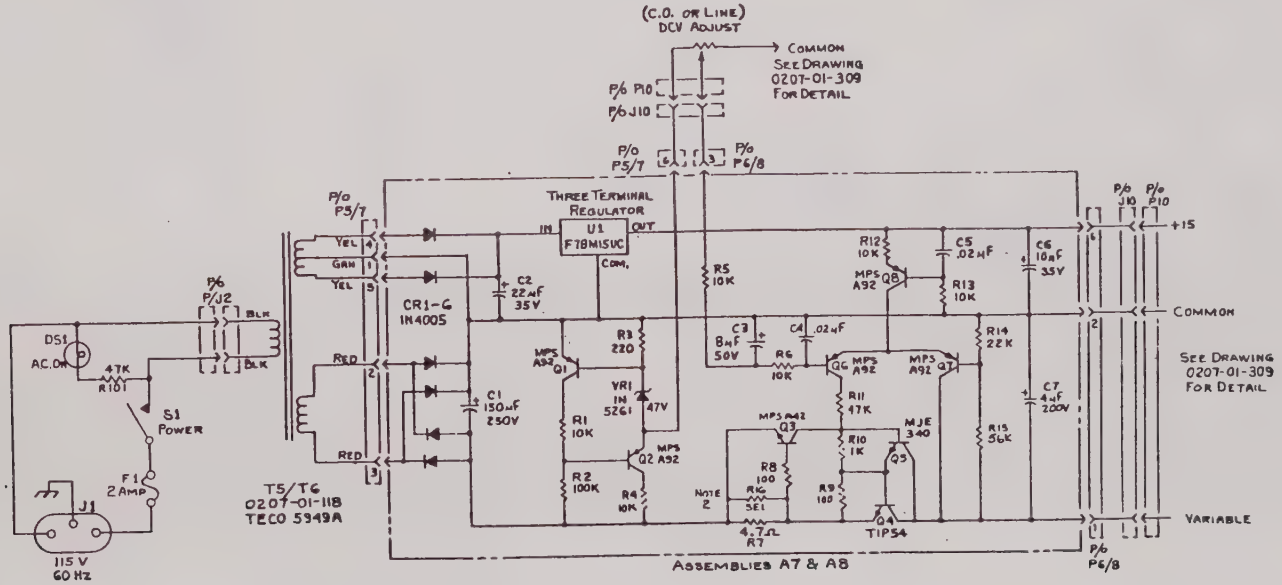


FIGURE 8-10
P.C. ASSEMBLY
SET POWER SUPPLY



NOTES:

1) PLUG & TRANSFORMER NOS REFERENCED TO DRAWING 0207-01-301

2) SELECTED VALUE FOR CURRENT LIMIT.

3) LAST NOS

R-16
C-7
CR-6
VR-1
Q-8
U 1

FIGURE 8-11
SCHEMATIC
BIAS POWER SUPPLY

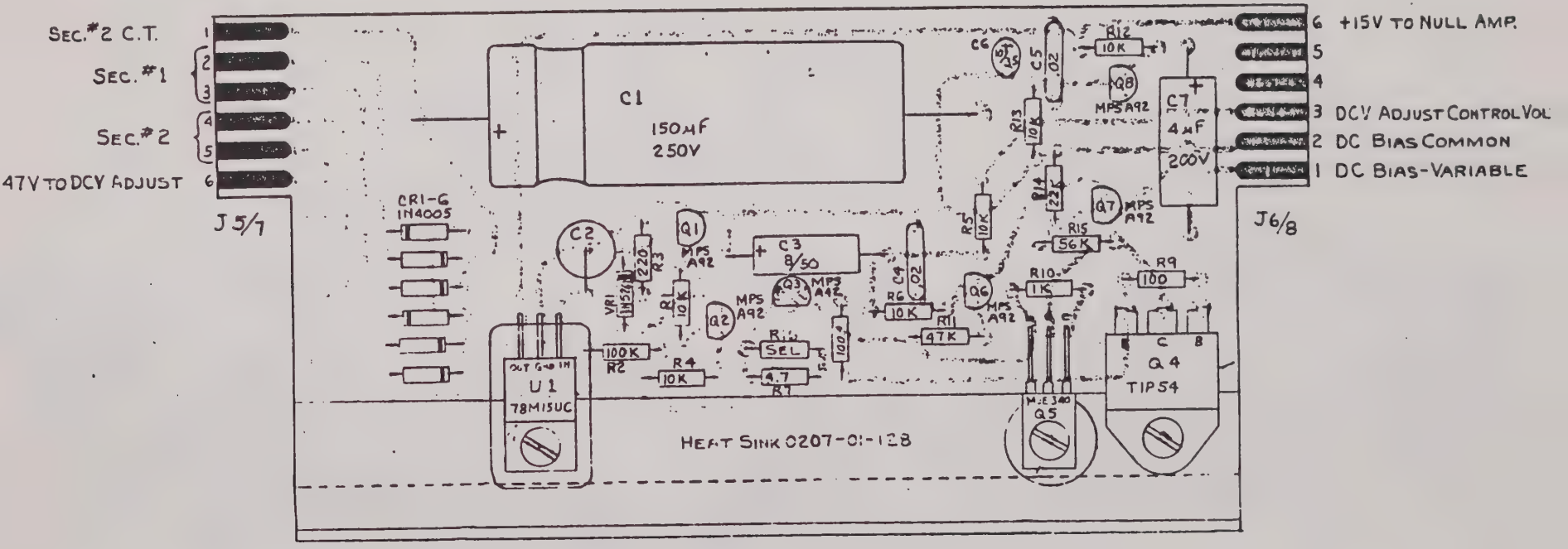


FIGURE 8-12
P.C. ASSEMBLY
BIAS POWER SUPPLY

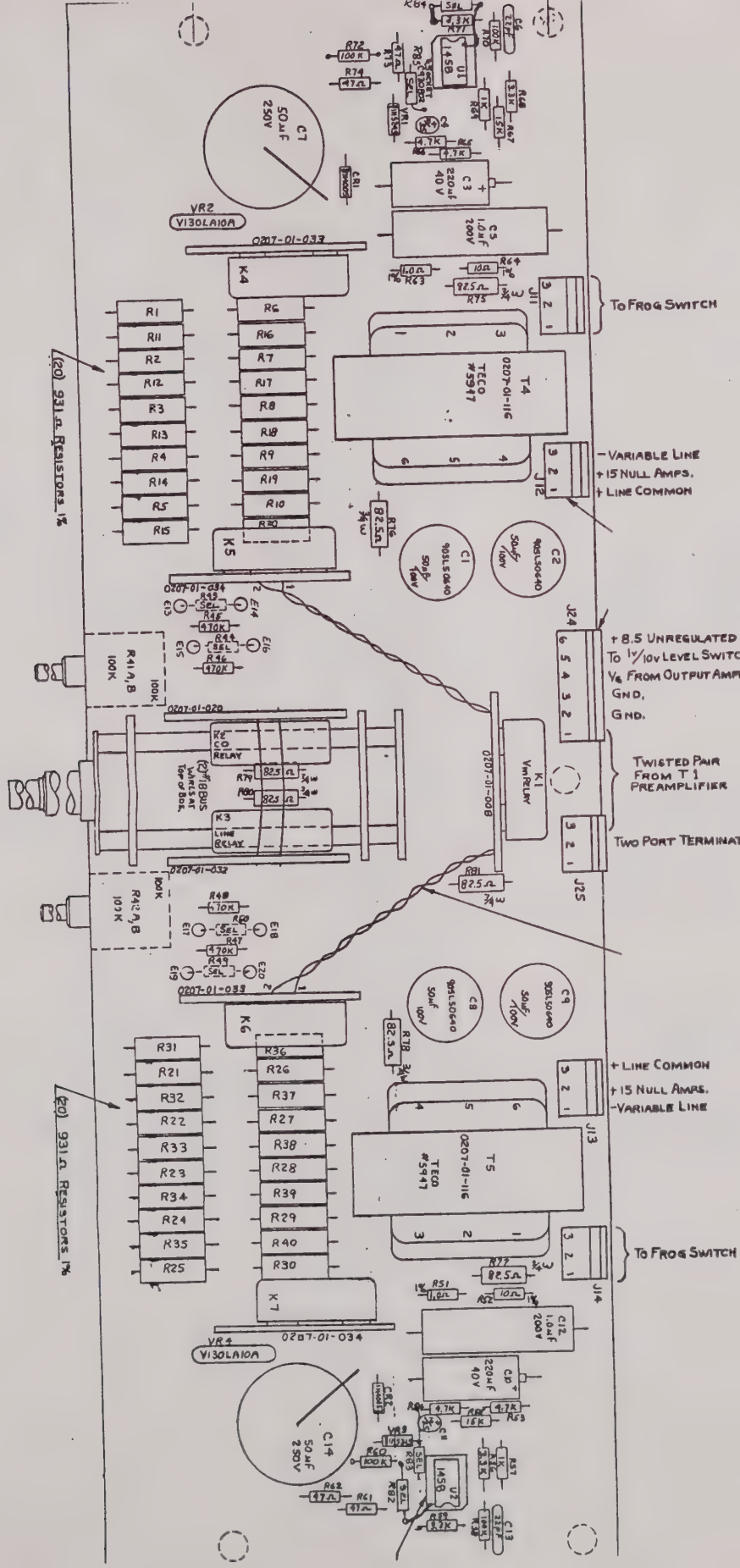


FIGURE 8-13
P.C. ASSEMBLY
BALANCE CIRCUIT

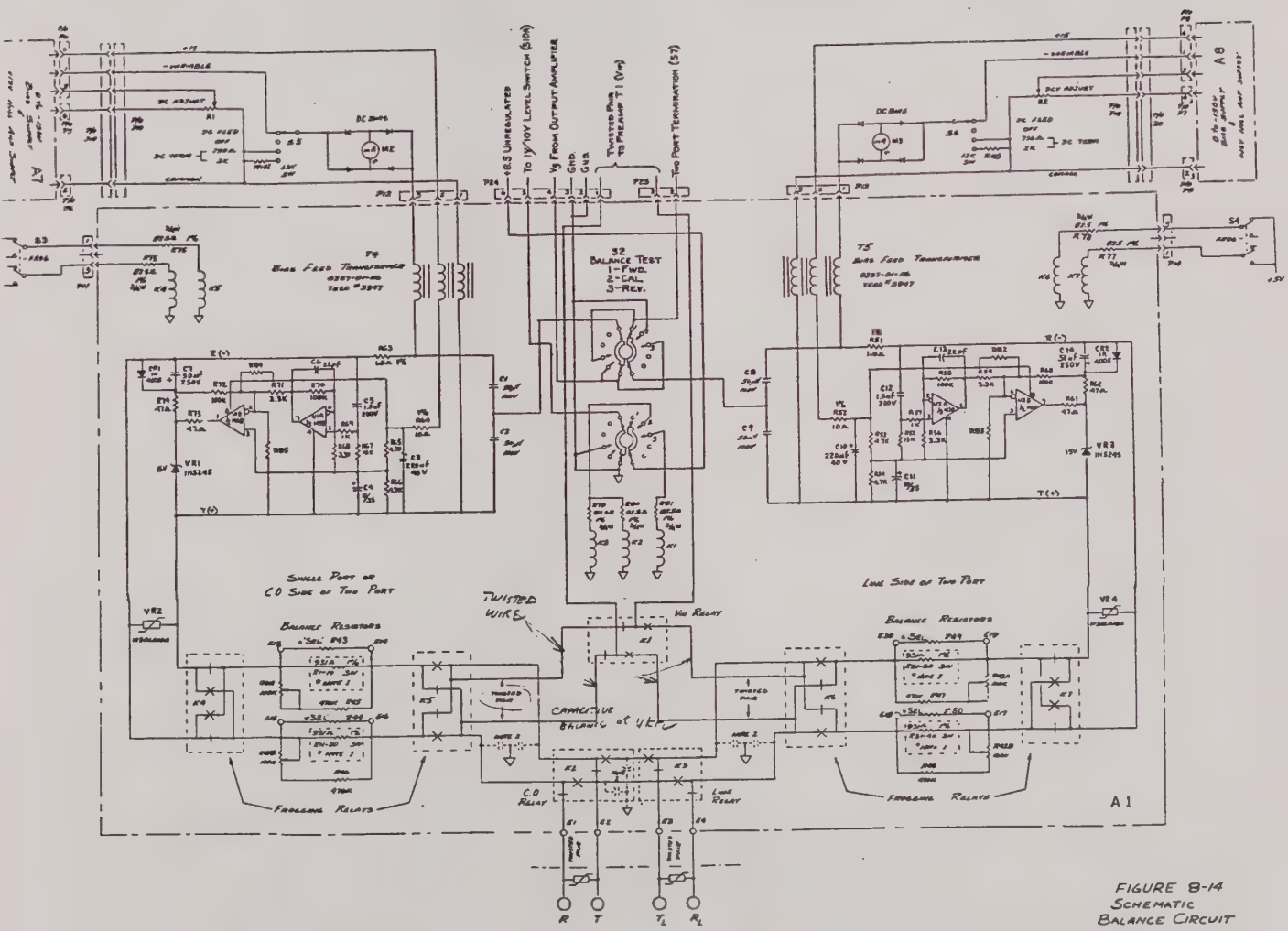


FIGURE 8-14
SCHEMATIC
BALANCE CIRCUIT

9.0 PARTS LIST

9.1 General

9.1.01 The Parts Lists provided on the following pages supply the description of the various assemblies, sub-assemblies and components that make up the Model T207 Longitudinal Balance Test Set.

9.1.02 For those components purchased by Wilcom, the manufacturer and manufacturer's part number are provided. Those components manufactured by Wilcom are identified by a Wilcom part number.

9.1.03 Any required items may be ordered direct from Wilcom Products, Inc. or the manufacturer.

C.O. SIDE or the LINE SIDE with the opposite T-207 port providing the DC termination, e.g., C.O. SIDE switch position D.C. FEED: LINE SIDE switch position D.C. TERM.

CAUTION: Before selecting a D.C. FEED switch position during initial set-up verify the associated DCV ADJUST is fully counterclockwise to prevent excessive current application to the specimen.

C.O. SIDE T-R: This section is used for both one and two port specimens.

SWITCH POS: Record the switch position, e.g., DC FEED, OFF, DC TERM 750 or TERM 2K.

BIAS mA: One port: select DC FEED switch position; adjust DCV ADJUST for desired current. Two port: choose 750 Ω or 2K Ω DC TERM at one port, adjust DCV ADJUST at other port for desired current.

LINE SIDE T_L-R_L: This section is used only with two port specimens. Information is recorded in the same manner as for the C.O. SIDE T-R section.

CAL LEVEL: After performing the CALIBRATION procedure at 40 Hz and with the BALANCE TEST switch in the CAL position, record the poorest BALANCE dB reading (switch setting plus meter scale reading plus 20 dB) obtained with any FROG switch combination for each test frequency.

Vg: The T207 provides two switch selected, fixed levels for single frequency longitudinal voltage signals. Readings should be made at both levels. If there is a difference in Balance dB readings, susceptibility to signal level should be suspected. The SIGNAL controls are interlocked to provide only a 1V BROADBAND signal.

FWD: T and R BALANCE: Select the BALANCE TEST switch FWD position. For one port specimens, record the BALANCE dB readings (switch setting plus meter scale reading) obtained with both positions of the FROG switch in the two sections of the SHUNT BAL. column for the appropriate Vg level. For two port specimens, select the TWO PORT termination (e.g., SHUNT or SERIES BALANCE) and record the BALANCE dB readings obtained for both positions of the FROG switch in the corresponding BAL. column (e.g., SHUNT or SERIES BAL) for the appropriate Vg level.

REV: T_L AND R_L BALANCE: For two port specimens, select the BALANCE TEST switch REV positions and record the BALANCE dB readings in the same manner as the FWD measurements.

T207 LONGITUDINAL BALANCE TEST SET (0207-01-901)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
	Overall Assembly	1	Wilcom	0207-01-001
	Mainframe Assembly	1	Wilcom	0207-01-014
	Power Support Tray Assembly	1	Wilcom	0207-01-013
	Cover Assembly	1	Wilcom	0194-00-298
	Case Assembly	1	Wilcom	0194-00-299
	Power Cord	1	Belden	17258
	Manual	1	Wilcom	0207-01-600
	Data Sheet	1	Wilcom	0207-01-601

COVER ASSEMBLY (0194-00-298)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
	Cover	1	Zero	Z164-Z44ACF-48
	Cover Drilling	1	Wilcom	0194-00-139
	Strike, Part of Mfr. Latch No.	4	Zero	ZSP2-220

CASE ASSEMBLY (0194-00-299)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
	Case	1	Zero	Z164-Z44A
	Case Drilling	1	Wilcom	0194-00-137
	Rubber Bumpers	2	Russel	REC 20975
	Handle	1	Wilcom	0051-00-132

MAINFRAME ASSEMBLY (0207-01-014)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
	Panel Hardware Assembly	1	Wilcom	0207-01-012
A3	P.C. Assembly, Meter Circuit	1	Wilcom	0207-01-004
A2	P.C. Assembly Preamplifier & Attenuator	1	Wilcom	0207-01-037
A4	P.C. Assembly, Oscillator & "C" Message	1	Wilcom	0207-01-005

A5	P.C. Assembly Freq. Disp. & Output Amp	1	Wilcom	0207-01-006
A1	P.C. Assembly, Balance Circuit & Null Amp	1	Wilcom	0207-01-039
	Knob, Bar	4	Buckeye	PS-70BL-2 Black
	Knob, Round	1	Buckeye	PS-175-2 Black
	Knob Round	2	Buckeye	PS-70-2 Black
	Knob, Round	2	Buckeye	PS-70-1 Black
	Bracket, Case Mounting (Rev D up)	3	Wilcom	0132-10-123
P24	Plug, 6 pin	1	Molex	09-50-3061
P25	Plug, 3 pin	1	Molex	09-50-3031
	Pins	9	Molex	08-50-0108

POWER SUPPORT TRAY ASSEMBLY (0207-01-013)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
	Tray-Power Support	1	Wilcom	0207-01-113
T2,3	Transformer, Bias Power 5949A	2	Teco	0207-01-118
T1	Transformer, Bias Power 6062	1	Teco	0207-01-119
	Capacitor, Electrolytic 15V 15000 µf	1	GE	86F520M
	Clamp	1	Augat	51361-4
A7,8	P.C. Assembly Bias Power Supply	2	Wilcom	0207-01-010
A6	P.C. Assembly, Set Power Supply	1	Wilcom	0207-01-011
P4-8	Connector, 6 pin	5	Waldom/Molex	09-01-1061
P3	Connector, 9 pin	1	Waldom/Molex	09-01-1091
	Pins	19	Waldom/Molex	08-01-0102
	Pins	20	Waldom/Molex	08-01-0106
J9,10	Connector, 10 pin	2	AMP	1-480286-0
J2	Connector, 6 pin	1	AMP	1-480-271-0
	Pins	26	AMP	60618-4
	Label: Danger High Voltage		Bovie	WP-100

PANEL HARDWARE ASSEMBLY (0207-01-012)

Ref. Desig.	Description	Qty	Mfr.	Manufactruer's Number
	Panel	1	Wilcom	0207-01-101
	Handles	2	Bud	H-9111
	Binding Post	4	Grayhill	29-1B
	Binding Post	2	Grayhill	29-1R
	Fuse Holder	1	Buss	HTA
	Switch DPDT	1	Switchcraft	4006
	Switch DPDT	2	Alco	MST-205N
	Switch SPDT	1	Alco	MST-105D
	Switch, Rotary 1 Pole, 4 Pos.	2	Centralab	SA-200-4B

Potentiometer 20K	2	Allen Bradley	RV4NAYSD203A
Switch; Press Lite with Hardware	1	Marco/Oak	616-6-1
Lamp	1	Chicago-Min	A1H
Fuse	1		
Display Lens	1	Wilcom	0179-00-122
AC Socket	1	Switchcraft	LAC3G
Vinyl Boot	1	Wilcom	0132-10-133
Jack	2	Switchcraft	12B (310)
Left Card Guide Assembly	1	Wilcom	0207-01-029
Right Card Guide Assembly	1	Wilcom	0207-01-028
Tie Bar	2	Wilcom	0207-01-121
Meter, Balance	1	Ammon	0207-01-114
Meter, Line Bias	2	Ammon	0207-01-102
Resistor 1.2K 5W	2	Sprague	243E1225
Resistor 1% 1/8W 2K	1	TRW/IRC	RN55D2001F
Terminal Strip	1	Cinch	55A
Varistor	2	GE	V130LA10A
Resistor ¼W 5% 47K	1	TRW/IRC	RG¼473J
P.C. Assembly, Meter Bridge	2	Wilcom	0207-01-027
Wiring Harness No 1	1	Wilcom	0207-01-017
Wiring Harness No 2	1	Wilcom	0207-01-023

PRINTED CIRCUIT ASSEMBLY METER CIRCUIT - A3 (0207-01-004)

Ref. Desig.	Description			Qty	Mfr.	Manufacturer's Number
	P.C. Board				Wilcom	0207-01-104
R2	Resistors	1/8W 1%	681Ω	1	TRW/IRC	RN55D6810F
R4	"	" "	1.1K	1	"	" 1101F
R15	"	" "	2.26K	1	"	" 2261F
R1,16	"	" "	3.32K	2	"	" 3321F
R3	"	" "	9.53K	1	"	" 9531F
R5,7,8,10,11	"	" "	10.0K	5	"	" 1002F
R6	"	" "	20.0K	1	"	" 2002F
R12	"	" "	21.5K	1	"	" 2152F
R18	"	" "	100K	1	"	" 1003F
R9,13,17,21	Resistors	¼W 5%	4.7K	4	TRW/IRC	RG¼472J
R19,22	"	" "	10K	2	"	"103J
R14	Variable Resistors		10K	1	Bourns	3389-P-103
R20	" "		20K	1	"	3009P-1-203
C1,2,3,4,5	Capacitors, Solid Tant.		35V 10µf	5	ITT	TAG-00-10.0/35-50/20
C6	Capacitors, Disc Ceramic		.01µf	1	Erie	811-000-25U0-103M
VR1	Voltage Ref. Diode			1	Motorola	IN4576
CR1,2,3,4,5	Diodes			5	ITT	IN4148
U1,2	Integrated Circuits			2	Motorola	MC1458P1

PRINTED CIRCUIT ASSEMBLY PREAMPLIFIER & ATTENUATOR - A 2 (0207-01-037)

Ref. Desig.	Description			Qty	Mfr.	Manufacturer's Number
	P.C. Board			1	Wilcom	0207-01-137
R3,R14	Resistors	¼W, 1%	100Ω	2	TRW/IRC	T055 1000F
R4,R13	"	" "	215Ω	2	" "	" 2150F
R19	"	" "	274Ω	1	" "	" 2740F
R5,R12	"	" "	681Ω	2	" "	" 6810F
R6,R11	"	" "	2.15K	2	" "	" 2151F
R18	"	" "	3.32K	1	" "	" 3321F
R24	"	" "	6.65K	1	" "	" 6651F
R7,10	"	" "	6.81K	2	" "	" 6811F
R20	"	" "	9.53K	1	" "	" 9531F
R23	"	" "	22. 1K	1	" "	" 2212F
R25	"	" "	249.0 K	1	" "	" 2493F
R21	Resistor	¼W 5%	510Ω	1	TRW/IRC	RG¼ 511J
R1	"	" "	680Ω	1	" "	" 681J
R15	"	" "	820Ω	1	" "	" 821J
R8,26,27	"	" "	1K	3	" "	" 102J
R9	"	" "	3.3K	1	" "	" 332J
R2	"	" "	7.5K	1	" "	" 752J
R16,22	"	" "	10K	2	" "	" 103J
R17	"	" "	100K	1	" "	" 104J
C1,2	Capacitors, Alum. 250V 50µ			2	Sprague	39D506F250JE4
C3	" Ceramic	500V	.005 µf	1	Erie	811-000-X5R0-502K
C4,7,9	" Ceramic	500V	470 pf	3	Erie	831-000-X5F0-471K
C5	" Tant	10V	220µf	1	Sprague	150D227X90105
C8	" Mylar	100V	.1µf	1	Sprague	225P10491WD3
C10,11,12	" Mylar	100V	.018µf	3	Sprague	225P18391WD3
C13,14,15	" Tant	35V	10µf	3	ITT	GA010G100
C6	" Tant	10V	1µf	1	Sprague	150D105X9010A
	Fiber Washer			2	Seastrom	5602-71-62
Q1,2	Transistor Silicon		NPN	2	Motorola	MPS6521
Q3	Transistor Silicon		PNP	1	Motorola	MPS6523
U1,U2	Integrated Circuit			2	Motorola	MC1458P1
CR1	Diode			1	Motorola	IN4148
K1	Relay, 6V			1	Magnecraft	W172DIP-2
T1	Transformer	TECO	6432	1	Wilcom	0207-01-136
SZ	Switch			1	Wilcom	0194-00-108
J16	Molex Connector			1	Molex	09-65-1031
J15	Molex Connector			1	Molex	09-65-1061
	Support Bracket			1	Wilcom	0207-01-125
	Support Bracket			1	Wilcom	0207-01-140
	Swage Standoff			2	Amatom	9531B-B-0440-3A

PRINTED CIRCUIT ASSEMBLY OSCILLATOR & C-MESSAGE-A4 (0207-01-005)

Ref. Desig.	Description			Qty	Mfr.	Manufacturer's Number
	P.C. Board			1	Wilcom	0207-01-105
R29	Resistors	1/8 W - 1%	274Ω	1	TRW/1RC	RN55D2740F
R28	"	" "	3.32K	1	"	" 3321F
R30,31	"	" "	9.53K	2	"	" 9531F
R18,19,20	"	" "	10.0K	3	"	" 1002F
R17	"	" "	20.0K	1	"	" 2002F
R40	"	" "	26.1K	1	"	" 2612F
R32	"	" "	36.5K	1	"	" 3652F
R39	"	" "	49.9K	1	"	" 4992F
R5	"	" "	11.5K	1	"	" 1152F
R33,34	"	" "	3.65K	2	"	" 3651F
R36	Potentiometer		10K	1	Bourns	3389-P-103
R1A, 1B	Potentiometer Dual		10K	1	Clarostat	CM41114
R12,22	Potentiometer		100K	2	Bourns	3009P-1-104J
R13,14	Resistors	¼ W 5%	47Ω	2	TRW/1RC	RG¼470J
R16	"	" "	100Ω	1	"	100J
R37	"	" "	470Ω	1	"	471J
R2,8,24,25	"	" "	1K	4	"	102J
R23	"	" "	4.7K	1	"	472J
R27	"	" "	6.8K	1	"	682J
R3,6,9,35	"	" "	10K	4	"	103J
R38	"	" "	15K	1	"	153J
R11,15,26	"	" "	100K	3	"	104J
R21	"	" "	330K	1	"	334J
R4,10	"	" "	2.2M	2	"	225J
	Dogbone Spacers			4	Centralab	CRLJ6428
C1,6,11,12,22,23	Capacitors Tant	35V	10µf	6	ITT	GA010G100
C2,4	Capacitors, Mylar	100V	.0033µf	2	Sprague	225P33291WD3
C3,5,17	Capacitors, Mylar		.033µf	3	Sprague	225P33391WD3
C7	Capacitors, Solid Tant	10V	100µf	1	Sprague	150D107X9010R
C8,9,10	Capacitors, Solid Tant	20V	2.2µf	3	Sprague	150D255X9020A
C13,14	Capacitors, Mylar	100V	.01µf	2	Sprague	225P10391WD3
C15	Capacitors, Mylar	100V	.15µf	1	Sprague	225P1549R75
C16,18	Capacitors, Mylar	100V	.018µf	2	Sprague	225P18391WD3
C19	Capacitors, Monolythic		.1µf	1	Sprague	7C023104X0500D
C20,21	Capacitors, Mylar		.0022µf	2	Sprague	225P2291WD3
L1,2	Inductor, TECO #3890		265 ma	2	Wilcom	0132-10-108
UL3,5	Integrated Circuits			3	Raytheon	RC4558DN
U2,6	Integrated Circuits			2	Motorola/equiv.	741
U4	Integrated Circuits			1	RCA	CA3080
S1	Switch			1	Wilcom	0207-00-122
	Connectors			2	Molex	09-65-1061
	Oscillator Drive			1	Wilcom	0207-01-029
	Drive Assembly Ref. Drawing			REF.	Wilcom	0207-01-025

	Nylon Spacer	4	H.H. Smith	4003
	Bracket	1	Keystone	631
	Standoffs	2	Amatom	8276-B-0440
	Standoffs	1	Amatom	8158-A-0440
	Bushing Reducer For Oscill. Drive	1	Wilcom	0207-01-135

PRINTED CIRCUIT ASSEMBLY, FREQUENCY DISPLAY: OUTPUT AMP.-A5- (0207-01-006)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
	P.C. Board	1	Wilcom	0207-01-106
R31	Resistor, ±1%, ½ W 604 ohm	1	TRW/IRC	T055
R21	" " " 7.50 K	1	"	"
R22	" " " 20. 0 K	1	"	"
R23	" " " 41. 2 K	1	"	"
R20	" " " 49. 9 K	1	"	"
R2	" " " 84. 5 K	1	"	"
R29,30	Resistor, ±5%, ½ W 22 ohm	2	TRW/IRC	RG-¼
R27	" " " 100 ohm	1	"	"
R28	" " " 220 ohm	1	"	"
R16	" " " 470 ohm	1	"	"
R19	" " " 680 ohm	1	"	"
R6,18	" " " 1 K	2	"	"
R17,24	" " " 1.5 K	2	"	"
R26	" " " 2.2 K	1	"	"
R8,5	" " " 4.7 K	2	"	"
R12,15	" " " 6.8 K	2	"	"
R1,7,9,10,11,13	" " " 10 K	6	"	"
R25	" " " 27 K	1	"	"
R3	" " " 100 K	1	"	"
R14	" " " 330 K	1	"	"
R4	" " " 15 K	1	"	"
C5,6,8-11	Capacitor, Dipped Tant., ±50/-20%,35V 10µ	6	ITT	TAG-00-10.0/35-20/5(
C1,2	Capacitor, Mylar, ±10%, 100V .1µf	2	Sprague	225P10491WD3
C7	Capacitor, Ceramic Disc,500V, ±.5pf 10 pf	1	Erie	831-000-COGO-100D
VR1,2	Diode, Zener, 6.4 V	2	Motorola	IN4576
CR3,4	Diode, Germanium, 60V	2	Motorola	IN270
CR6,7	Diode, Silicon, lamp, 600 V	2	Motorola	IN4005
CR1,2,5	Diode, Small Signal, 100 V	3	Motorola	IN4148
Q2,3	Transistor	2	Motorola	MPS6523
Q4-6	"	3	Motorola	MPS6521
Q7,10	"	2	Motorola	2N4355
Q8,9	"	2	Motorola	2N3568
Q1	"	1	Motorola	2N5961
U1,10	IC, OP Amp	2	Motorola	Mc1458P1

U2,3	IC, Divide by 12	2	T.I.	SN7492N
U4	IC, Positive Nand, 2 input	1	T.I.	SN7400N
U5	IC, Positive Nand, 3 input	1	T.I.	SN7410N
U11	IC, Op Amp	1	Raytheon	RC741DN
	Connector, 8 pin	1	Molex	09-65-1081
	Connector, 6 pin	1	Molex	09-65-1061
	Pins, edge	3	Vector	K23A
	Pins, edge	3	Vector	K28-1A
	P.C. Board	1	Wilcom	0207-01-107
	Standoff, Swage	2	Amatom	9536B-A-0440
	I.C. Socket, 16 pin	4	Cinch	16-DIP
	I.C. Numeric Display with Logic	4	T.I.	TIL307

P.C. ASSEMBLY, BALANCE CIRCUIT & NULL AMPS - A1 (0207-01-039)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
	P.C. Board	1	Wilcom	0207-01-139
	Swage Standoff	5	Amatom	9546B-A-0632
	P.C. Assembly, Frogging Relay,K4,6*	2	Wilcom	0207-01-033
	P.C. Assembly, Frogging Relay,K5,7*	2	Wilcom	0207-01-034
	P.C. Assembly, C. O. Relay*	1	Wilcom	0207-01-020
	P.C. Assembly, Line Relay*	1	Wilcom	0207-01-032
	P.C. Assembly, VM Relay*	1	Wilcom	0207-01-008
	*Relay		Clare	HGJ2MT54211G00
R75 - 81	Resistor, ±1%, 3/4 W 82.5 ohm	7	TRW/IRC	T060
R61,62,73, 74	Resistor, ±5%, ½ W 47 ohm	4	TRW/IRC	RG-½
R57,69	" " " 1 K	2	"	"
R56,59, 68,71	" " " 3.3 K	4	"	"
R53,54, 65,66	" " " 4.7 K	4	"	"
R55,67	" " " 15 K	2	"	"
R58,60, 70,72	" " " 100 K	4	"	"
R45 - 48	" " " 470 K	4	"	"
R43,44, 49,50	" " " SEL	4	"	"
R52,64	Resistor, ±1%, ½ W 10 ohm	2	TRW/IRC	T055
R51,63	" " " 1.0 ohm	2	"	TF07
R1 - 40	Resistor ±1%, 3W 931 ohm	40	RCL	T2A-931
R41A,B, 42A, 42B	Potentiometer, Dual 100 K	2	Clarostat	CM41184
C5,12	Capacitor, Metalized Polycarbonate, 200 V 1µf	2	F-Dyne	MPC-21-1.00-200-5
C4,11	Capacitor, Dipped Tant. 35V 10µf	2	ITT	TAG-00-10.0/35-50/20
C7,14	Capacitor, Alum. Elec., 250V 50µf	2	Sprague	39D506F250JE4

C1,2,8,9	Capacitor, Elect. Non-Polar, 100 V 50µf	4	G.I.	905L50640
C3,10	Capacitor, Alum. Elect., 40 V 220µf	2	Siemens	B41283
C6,13	Capacitor, Disc Ceramic, 500 V 22 pf	2	Erie	831-000-U2J0-220J
	Capacitor, Miniature Ceramic, Trimmer, Select at test	1	Erie	538-011,A2-8pf
	Capacitor, Miniature Ceramic, Trimmer, Select at test	3	Erie	538-011,B7-25pf
CR1,2	Diode, Silicon, 1 amp, 600 V	2	ITT	1N4005
VR1,3	Diode, Zener, ½ amp, 15 V	2	Motorola	1N5245
VR2,4	Varistor	2	G.E.	V130LA10A
U1,2	I.C., Dual Op Amp	2	Motorola	MC1458P1
J11 - 14,25	Jack, 3 pin	5	Molex	09-65-1031
J24	Jack, 6 pin	1	Molex	09-65-1061
	Transformer, Bias Feed, TECO #5947	2	Wilcom	0207-01-116
	Switch, Balance Test	1	Wilcom	0207-01-138
	Socket, I.C.	2	T.I.	C930802
	Fiber Washer	2	Seastrom	5602-71-62

PRINTED CIRCUIT ASSEMBLY, METER BRIDGE (0207-01-027)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
	P.C. Board	1	Wilcom	0207-01-127
	Diode, Silicon	4	ITT	IN4005

PRINTED CIRCUIT ASSEMBLY, BIAS POWER SUPPLY - A7,8 (0207-01-010)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
R7	Resistor ¼ W ±5% 4.7Ω	1	TRW/IRC	RG¼4R7J
R8,9	" " " 100Ω	2	"	" 101J
R3	" " " 220Ω	1	"	" 221J
R10	" " " 1K	1	"	" 102J
R1,4,5,6,12,13	" " 10K	6	"	" 103J
R14	" " " 22K	1	"	" 223J
R11	" " " 47K	1	"	" 473J
R2	" " " 100K	1	"	" 104J
R15	" " " 56K	1	"	" 563J
C4,5	Capacitors, Ceramic .02µf	2	Erie	841-000-25U0-203M
C7	Capacitors, Alum. 200 V 4µf	1	Sprague	500D405F200DC7
C3	Capacitors, Alum. 50 V 8µf	1	Sprague	TE1303.3
C6	Capacitors, Tant. 35V 10µf	1	ITT	TAG-00-10.0/35-50/
C2	Capacitors, Tant. 35V 22µf	1	Sprague	150D226X9035R
C1	Capacitors, Alum 250V 150µf	1	Sprague	

CR1-6	Diodes	6	ITT	IN4005
VR1	Zener Diode IN5261 47 V	1	Motorola	IN5261
Q1,2,6,7,8	Transistors	5	Motorola	MPSA92
Q3	Transistors	1	Motorola	MPSA42
Q4	Transistors	1	T.I.	TIP54
Q5	Transistors	1	Motorola	MJE340
U1	Regulator - 3 Terminal	1	Fairchild	F78M15UC
	U1 Insulating Hardware Kit	1	G.E.	138B8189GR11
	P.C. Board	1	Wilcom	0207-01-110
	Heat Sink	1	Wilcom	0207-01-128

PRINTED CIRCUIT ASSEMBLY SET POWER SUPPLY - A6 (0207-01-011)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
R3,4	Resistor ¼ W ±5% 22Ω	2	TRW/IRC	RG¼220J
R5,6	Resistor ¼ W ±5% 68Ω	2	TRW/IRC	" 680J
R2	Resistor ¼ W ±5% 10K	1	TRW/IRC	" 103J
R1	Resistor ¼ W ±5% 150K	1	TRW/IRC	" 154J
R7,8	Resistor ½ W ±5% 2.2Ω	2	TRW/IRC	" 2R2J
C3,4	Capacitors, Tant 20 V 1Ω µf	2	Sprague	150D105X9020A
C5,6,7	Capacitors, Tant 35 V 10Ω µf	3	ITT	TAG00-10.0/35-50/20
C1,2	Capacitors, Elect. 63 V 1000Ω µf	2	Siemens	B41-010-A8108-T
CR1,2,3,4	Diodes, Silicon	4	ITT	IN4005
CR5,6	Diodes, Silicon	2	PD&E	4722
Q1	Transistor	1	Motorola	MJE371
Q2	Transistor	1	Motorola	MJE521
U1	Integrated Circuit	1	Motorola	MC7805CP
U2	Integrated Circuit	1	Silicon Gen.	SG3501D
	P.C. Board	1	Wilcom	0207-01-111
	Heat Sink	1	Wilcom	0207-01-112

WIRING HARNESS NO. 1 ASSEMBLY (0207-01-017)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
	Connector Housing, 6 pin	1	Waldom/Molex	09-01-1061
	Pins	6	"	08-01-0106
	Connector Housing, 3 pin	3	"	09-50-3031
	Connector Housing, 6 pin	4	"	09-50-3061
	Connector Housing, 8 pin	1	"	09-50-3081
	Pins	41	"	08-50-0108
	Connector Housing,10 pin	1	AMP	1-480285-0
	Pins	16		60617-1
	Harness No.1	1	Wilcom	0207-01-015

WIRING HARNESS NO. 2 ASSEMBLY (0207-01-023)

Ref. Desig.	Description	Qty	Mfr.	Manufacturer's Number
	Connector Housing, 3 pin	2	Waldom/Molex	09-50-3031
	Pins	6	Waldom/Molex	08-50-0108
	Connector Housing, 10 pin	1	AMP	1-480285-0
	Pins	10	AMP	60607-1
	Harness No. 2	1	Wilcom	0207-01-021

10.0 DIFFERENCE DATA

10.1 General

10.1.01 This section of the manual indicates information relative to changes in circuitry, operation, and features of the Model T207/T207E Longitudinal Balance Test Set.

WILCOM PRODUCTS INC.
DANIEL WEBSTER HIGHWAY
P.O. BOX 508 LACONIA. N.H. 03246

MANUAL CHANGE INFORMATION

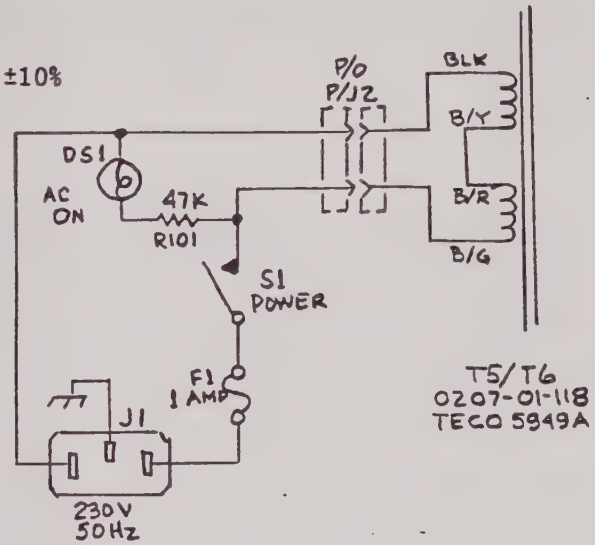
PRODUCT T207E | CHANGE REF. N/A | DATE

CHANGE	DESCRIPTION

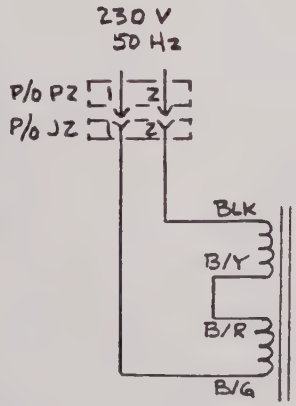
MODEL T207E: 230V Operation

The T207E is powered by 230V ±10%

BIAS POWER SUPPLY-
Schematic - Fig. 8-11



SET POWER SUPPLY -
Schematic - Fig. 8-9



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MANUAL CHANGE INFORMATION

PRODUCT T207E

CHANGE REF. N/A

DATE

CHANGE	DESCRIPTION

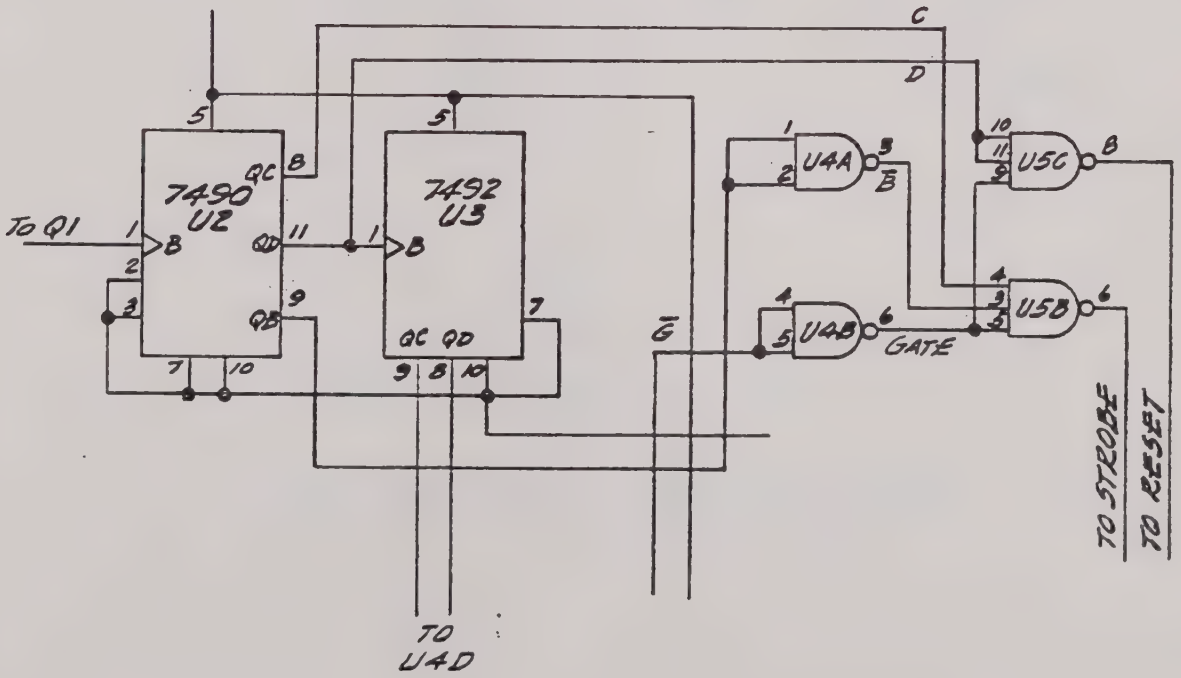
The frequency display logic for the Model T207E is changed to provide the correct frequency display using a 50 Hz power line as the time base.

PARTS LIST:

PRINTED CIRCUIT ASSEMBLY, FREQ. DISPLAY; OUTPUT AMP -A5- (0207-90-006)

Ref. Desig.	Description	Qty.	Mfr.	Manufacturer's Number
	P.C. BOARD	1	Wilcom	0207-90-106
U2	IC, Decade Counter	1	T.I.	SN7490N

SCHEMATIC: Fig. 8-6



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P.O. BOX 508 LACONIA, N.H. 03246

MANUAL CHANGE INFORMATION

PRODUCT T207

ASSEMBLY Freq. Display and Output Amplifier

CHANGE	DESCRIPTION
ECO #924 SERIAL #130	Gate U5A added to circuit to buffer Q1 output before clocking U2.
	PARTS LIST: NO CHANGE
REV	SCHEMATIC — Partial Revision

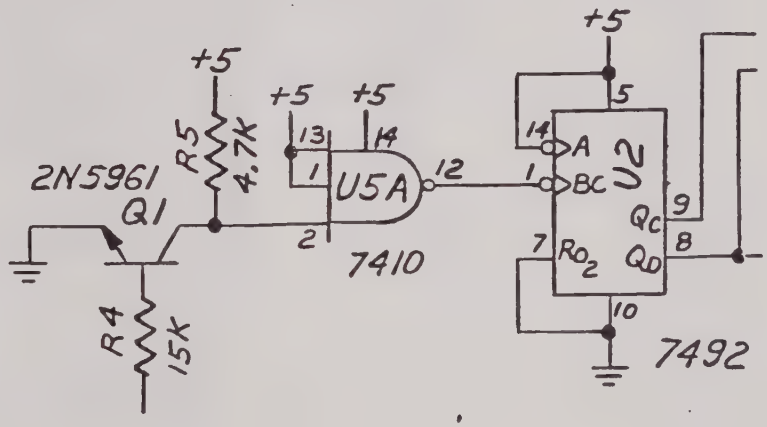

FIGURE 8-6

Schematic

Freq. Display and Output Amp.

REV — P.C. Assembly Frequency Display and Output Amp. -A5- (0207-01-006) Figure 8-5 revised and redrawn.

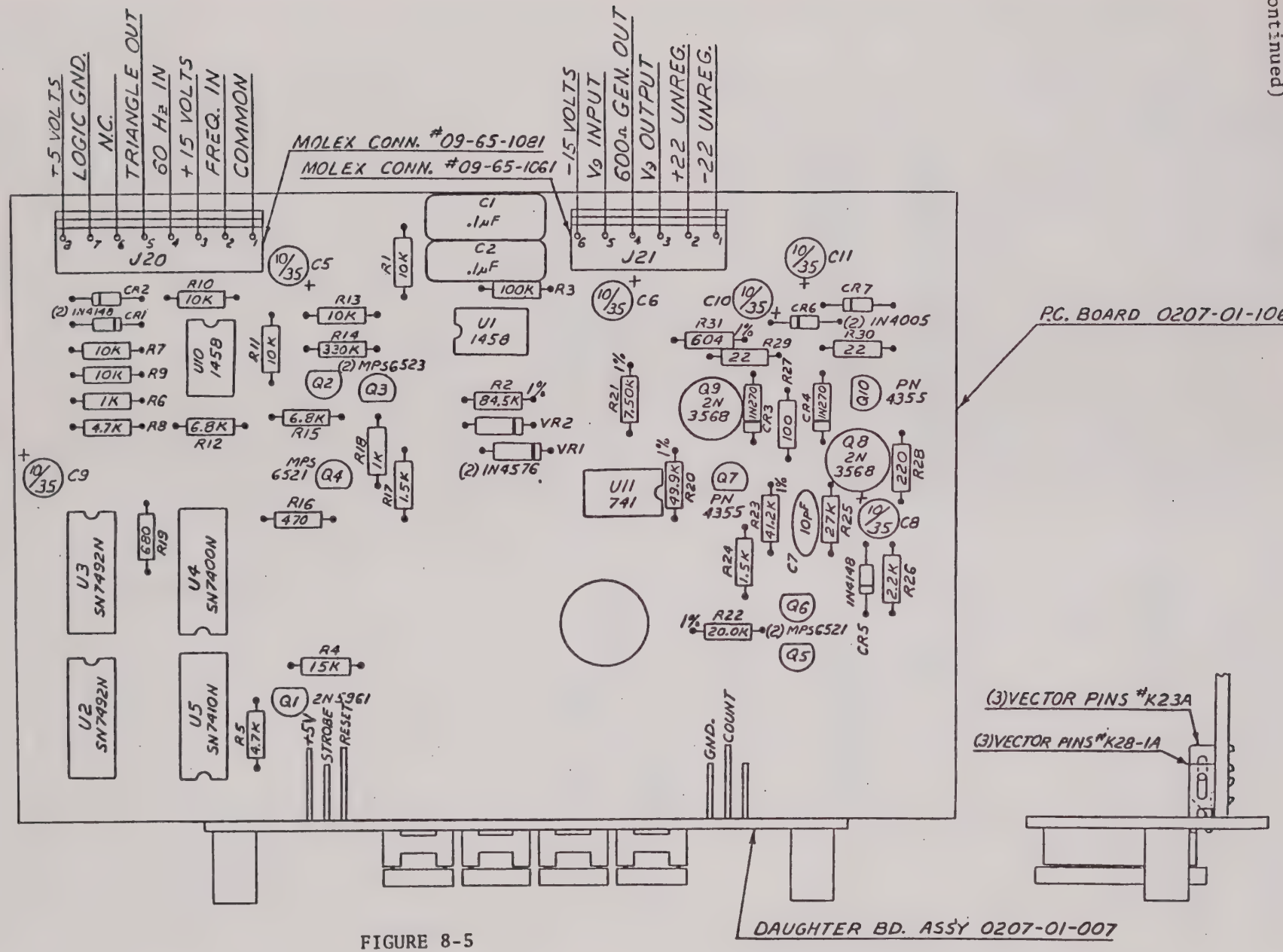

FIGURE 8-5

P.C. Assembly

Freq. Display and Output Amp.

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MANUAL CHANGE INFORMATION

PRODUCT T207

ASSEMBLY Balance Circuit

CHANGE	DESCRIPTION

ECO NO. 954

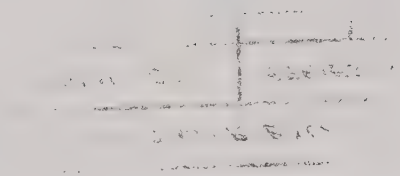
SER. NO. 142 and up

REV. BALANCE CIRCUIT PC ASSEMBLY, FIGURE 8-13, and BALANCE CIRCUIT SCHEMATIC, FIGURE 8-14

Capacitors C1, C2, C8 and C9 changed from 50µF/100V to 70µF/100V to guarantee a minimum of 50µF for adequate null adjustment.

REV. PARTS LIST: PC ASSEMBLY BALANCE CIRCUIT (A1)

Ref. Desig.	Description		Qty.	Mfr.	Manufacturer's Number
C1,2,8,9	Capacitor,Elect, Non-polar, 100V	70 µF	4	Trans Spectra	PC70MT100NP



Wilcom Products, Inc.
Laconia, N.H. 03246

DATA SHEET
MODEL T-207 LONGITUDINAL BALANCE TEST SET

wilcom

Company: _____

Specimen: _____

Ports: One __ Two __

Tester: _____

Date _____

Sheet No. _____

Comments:

FREQ	D.C. FEED				CAL LEVEL	V_g	FWD: T AND R BALANCE				REV: T_L AND R_L BALANCE			
	C.O. SIDE T-R		LINE SIDE T_L-R_L				SHUNT BAL		SERIES BAL		SHUNT BAL		SERIES BAL	
	SWITCH POS	BIAS mA	SWITCH POS	BIAS mA										
						10V								
						1V								
						10V								
						1V								
						10V								
						1V								
						10V								
						1V								
						10V								
						1V								
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						1V								
						10V								
						1V								
						10V								
						1V								
						10V								
						1V								

CALIBRATION:

SIGNAL: Single freq; BALANCE TEST: Cal;

Adjust the CAL control for either port for a maximum balance reading. Now throw the FROG switch for the same port; the meter will usually indicate a poorer balance. Adjust the CAL control to bring the reading part way back to what it was. Continue to adjust the CAL control while operating the FROG switch until the best reading which is the same in both positions of the FROG switch is obtained. Now repeat the same procedure for the other port. Repeat again for each port until the optimum CAL balance is obtained (balance should be 120 dB; switch setting plus meter scale reading plus 20 dB).

INSTRUCTIONS FOR COMPLETING T207 DATA SHEET:

Specimen: Tested equipment identifying information.

Ports: One or two ports indicates the applicable portions of the data sheets.

Freq: Record the single frequencies and/or broadband signal at which the specimen will be tested. Each frequency must be listed for every DC FEED condition evaluated.

D.C. FEED: If the specimen does not require bias current, this section is not used. With a two port specimen DC FEED may be from either the

Computation for each test case
Time to be obtained with sum
(Search should be done where

C.O. SIDE or the LINE SIDE with the opposite T-207 port providing the DC termination, e.g., C.O. SIDE switch position D.C. FEED: LINE SIDE switch position D.C. TERM.

CAUTION: Before selecting a D.C. FEED switch position during initial set-up verify the associated DCV ADJUST is fully counterclockwise to prevent excessive current application to the specimen.

C.O. SIDE T-R: This section is used for both one and two port specimens.

SWITCH POS: Record the switch position, e.g., DC FEED, OFF, DC TERM 750 or TERM 2K.

BIAS mA: One port: select DC FEED switch position; adjust DCV ADJUST for desired current. Two port: choose 750 Ω or 2K Ω DC TERM at one port, adjust DCV ADJUST at other port for desired current.

LINE SIDE T_L-R_L: This section is used only with two port specimens. Information is recorded in the same manner as for the C.O. SIDE T-R section.

CAL LEVEL: After performing the CALIBRATION procedure at 40 Hz and with the BALANCE TEST switch in the CAL position, record the poorest BALANCE dB reading (switch setting plus meter scale reading plus 20 dB) obtained with any FROG switch combination for each test frequency.

Vg: The T207 provides two switch selected, fixed levels for single frequency longitudinal voltage signals. Readings should be made at both levels. If there is a difference in Balance dB readings, susceptibility to signal level should be suspected. The SIGNAL controls are interlocked to provide only a 1V BROADBAND signal.

FWD: T and R BALANCE: Select the BALANCE TEST switch FWD position. For one port specimens, record the BALANCE dB readings (switch setting plus meter scale reading) obtained with both positions of the FROG switch in the two sections of the SHUNT BAL. column for the appropriate Vg level. For two port specimens, select the TWO PORT termination (e.g., SHUNT or SERIES BALANCE) and record the BALANCE dB readings obtained for both positions of the FROG switch in the corresponding BAL. column (e.g., SHUNT or SERIES BAL) for the appropriate Vg level.

REV: T_L AND R_L BALANCE: For two port specimens, select the BALANCE TEST switch REV positions and record the BALANCE dB readings in the same manner as the FWD measurements.